June 1984 An independent magazine published by ECC Publications

sinclair user

INCORPORATING **SPECTRUM USER**

Issue No 27

Only 85p

FREE SOFTWARE BOOKLET

Keyboard comparison— the facts at your fingertips

Does QL software live up to expectations?

Chess challenge— Spectrum versus Sensory 9



Victory beckons in the 1984 Cambridge Awards

more than £4,000 in prizes



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Most items are available from W H Smith, Boots, Spectrum Computer Centres and good computing shops or direct from:

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Sinclair User is published monthly by ECC Publications Ltd.

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01-359 3525
If you would like to contribute to Sinclair User please send programs, articles or ideas for hardware projects to:
Sinclair User,
ECC Publications,
196-200 Balls Pond Road,
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ISSN No 0262-5458
Printed and typeset by
Cradley Print PLC,
Warley,
West Midlands
Distributed by
Spotlight Magazine Distribution Ltd,
1 Benwell Road,
Holloway,
London N7
01-607 6411

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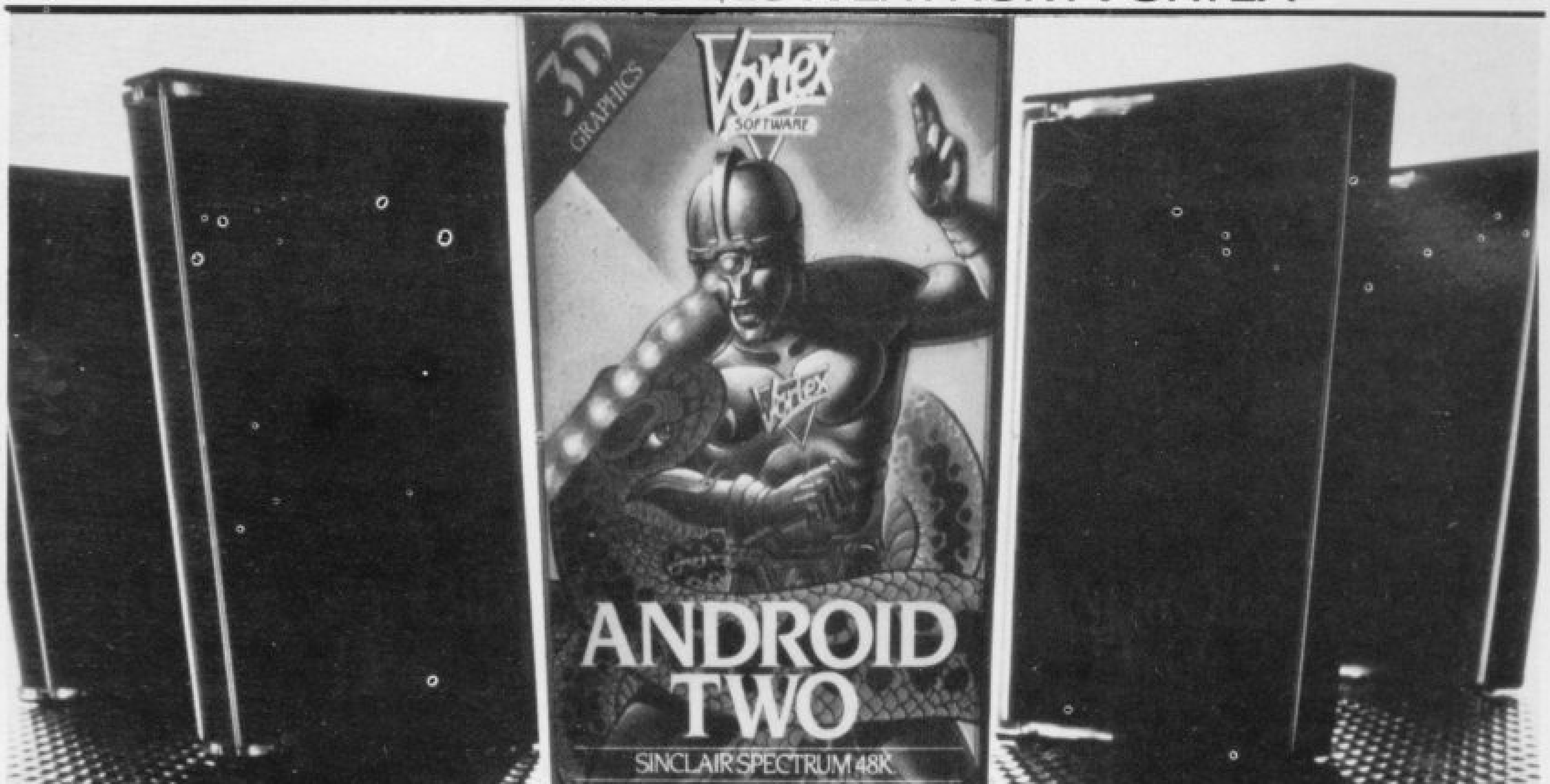
PLUS



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1982 revisited

WHEN THE QL computer was launched at the beginning of this year, Sinclair Research announced that the first deliveries were expected to take place at the end of February. Only a week or two later a spokesman for the company admitted that the demand was already greater than anticipated and they were "beginning to think about delivery problems and how to avoid them".

In March the company had, presumably, stopped thinking about avoiding those problems and had started to think of suitable excuses to explain the delays already incurred. Last-minute hitches in the operating system were disclosed, together with faults in one of the integrated circuits. By mid-April the company was talking, not too confidently, of deliveries at the end of the month, or possibly May or June.

As the French say, *plus ca change, plus c'est la meme chose* or, to put it another way, have we not heard that before somewhere?

It was, of course, less than two years ago when the ubiquitous Sinclair spokespeople were being wheeled out, rather like ventriloquists' dolls, to utter exactly the same vague excuses for Spectrum delivery delays. Two months after the Spectrum launch the official word from Sinclair was that delays had been caused "by the time needed to have production running smoothly" and problems had been exacerbated by the discovery of "a very obscure fault" in the design.

As the waiting period lengthened the excuses grew more feeble. In the October, 1982 issue of *Sinclair User* Clive Sinclair, as he then was, replied to the critics and apologised to his customers: "We are confident that our present backlog will be cleared by the end of September and hope that you will see current delays in the context of our successful delivery of more than 500,000 computers in the last two years".

'The computers on show at the January press launch were not fully operational'

In the event, delays continued until the end of October, with some customers complaining of waiting more than 20 weeks for their Spectrums to arrive. Since the launch six months had elapsed before Sinclair Research could ensure smooth production of the machine and yet throughout that period the company had continued to advertise the Spectrum with a promise of a 28-day turnaround on orders.

When the Advertising Standards Authority made its report later in 1982 it declared a record number of complaints received concerning non-delivery of Spectrums and went on to criticise the company for repeatedly advertising a product which it could not supply within the specified time.

Sinclair User, too, was inundated with letters from furious readers and in Sinclairvoyance, in October, 1982, we summed up the feelings of the public: "The company can advance any number of excuses but the fact remains that it has not been able to substantiate the claims made at the time of the launch . . . Sinclair Research has had experience of two previous machines yet still seems unable to profit from experience".

Eighteen months later and with yet another computer under its belt, Sinclair Research appears even more determined not to look back and learn from the mistakes of the past. In all respects save one, the company policy has remained the same, presumptiously assuming that customers are content to await the delayed delivery of the QL and attempting to placate the irate with promises of a gift as compensation. Remember that £10 voucher given to those who suffered the Spectrum delays?

Only in its advertising has the company acknowledged past errors. Heedful of the ASA breathing down its neck, it has inserted in recent advertisements for the QL the phrase: "Due to demand, delivery may take more than 28 days". At least the uninitiated now know what to expect.

One thing, however, is certain and that is that the computers on show at the January press launch were not fully operational and were only representing ideas-in-progress. Time will tell whether those ideas have come to fruition.

In all the excitement it is hardly surprising that little attention has been paid to the problems which currently beset the Spectrum. The 1983 pre-Christmas boom in Spectrum sales and the subsequent shortfall in supplies have apparently, and unexpectedly, carried over into 1984. Sales have remained high and many people are even now finding new Spectrums hard to come by.

'Little attention has been paid to the problems which currently beset the Spectrum'

While some retailers are claiming that they are receiving as many machines as they can handle, others report that they can obtain only a percentage of their requirements, a percentage which in some cases is as low as one-fifth the quantity ordered. The small independent computer stores are the worst affected, with some unable to get any at all.

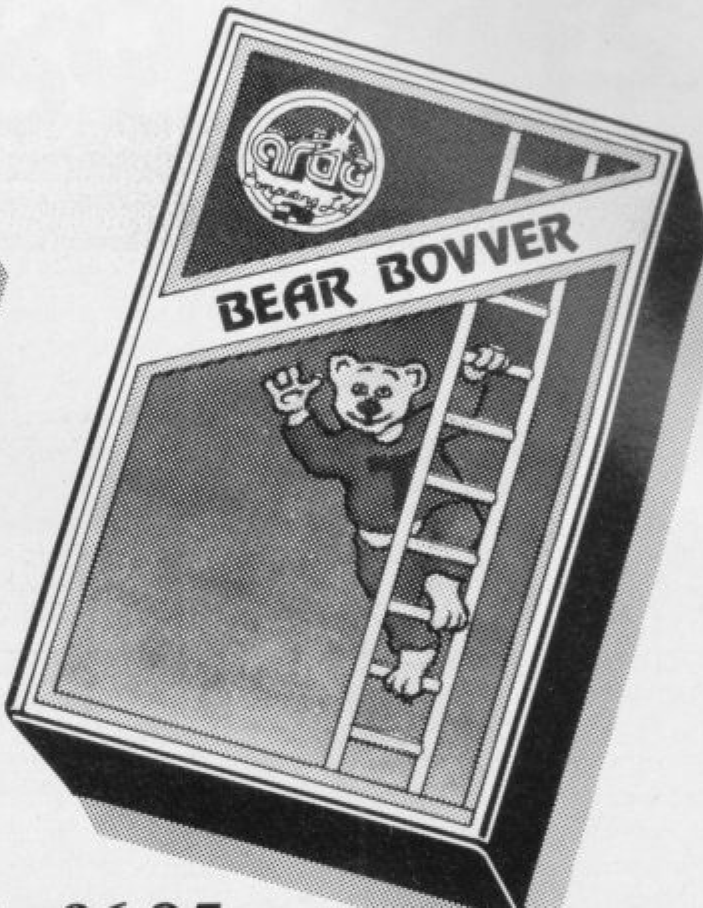
There is also reason to believe that the number of faulty Spectrums has increased and retailers have estimated that returned Spectrums could be as high as 25 percent of the total sold, considerably higher than the normal failure rate anticipated by Sinclair Research. *Sinclair User* has received many complaints from new Spectrum owners who are having to wait two months or more for faulty machines to be repaired or replaced.

All areas of industry suffer problems from time to time and the computer industry, being relatively new and continually covering fresh ground, is more susceptible than most. All the more reason, then, for computer manufacturers and their supporting companies to be circumspect in releasing new products and to improve their methods of handling unforeseen hitches.

On the other hand, a cynic might argue that the marketing strategy of companies like Sinclair Research is not only justified but also highly successful. New products are launched months before they are ready and in the intervening period interest is generated and orders pour in. When production eventually gets under way it can be geared carefully so that supply always falls a little short of demand and the products are endowed consequently with the added attraction of having rarity value.



Jet Set Willy **£5.95**

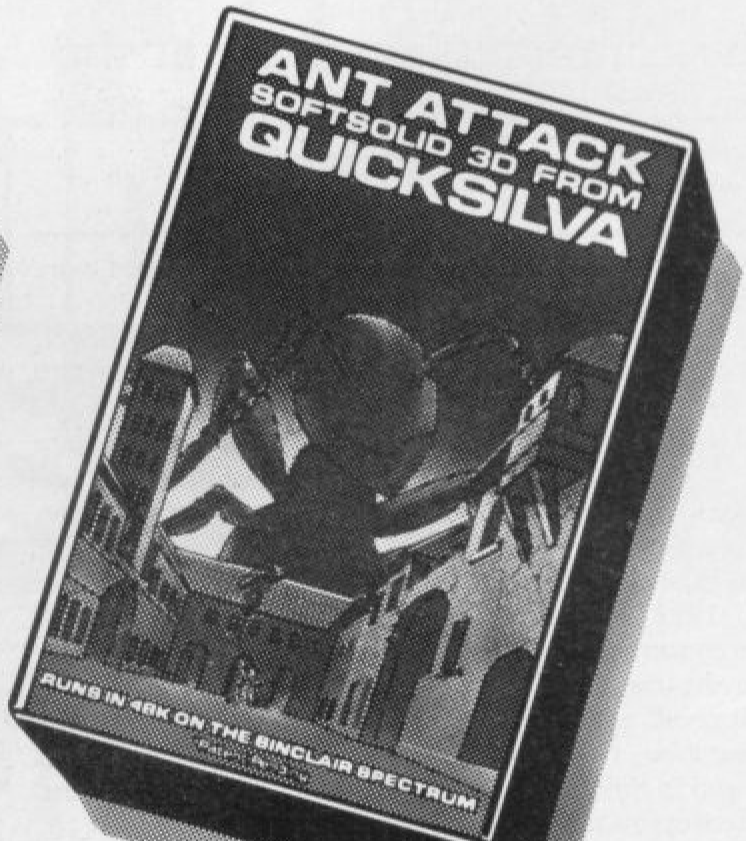


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Thousands of Spectrum

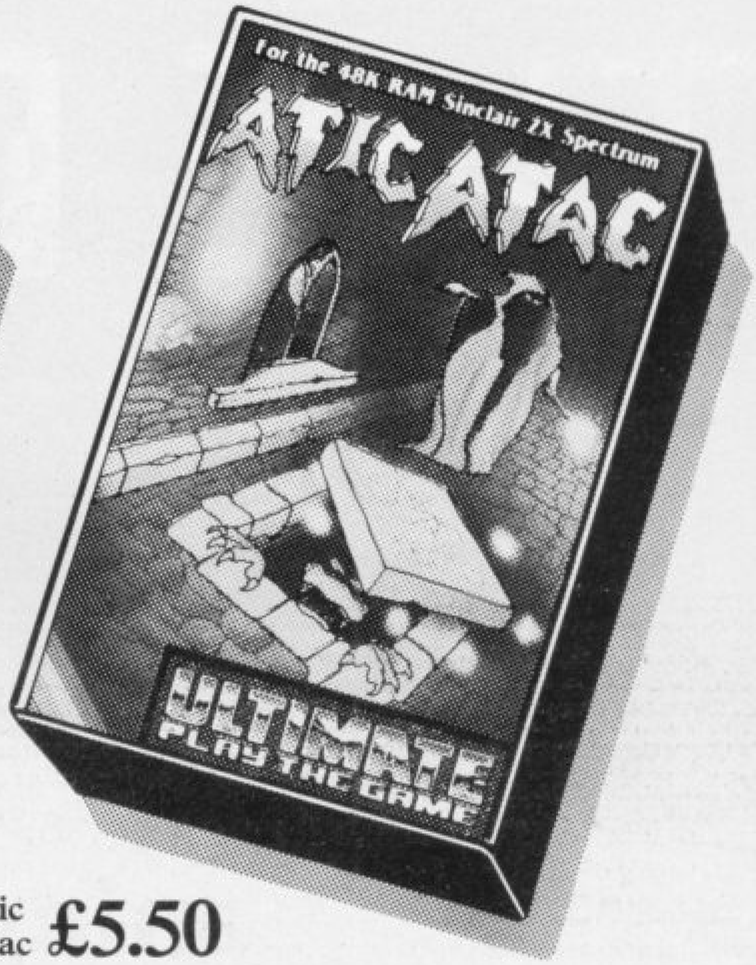


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This month we report on a Sinclair user who was in at the beginning

Mark 4 memories

WE FEATURE this month one of our members, Jeff Davis of Chichester. His interest in computers was sparked some years ago by the first Sinclair machine, a Sinclair Mark 4.

He says he had to assemble and solder the components on the printed circuit board and it was a very rudimentary machine by today's standards, with no luxuries such as resident Basic — not even a QWERTY keyboard, just a hex keypad.

Many a day was spent entering even a short, simple program. Luckily Davis had a friend who was an engineer and between them they managed to fit a keyboard to replace the hex keypad. That speeded things up and he was able to write simple utilities to enable him to program the machine more easily.

Eventually, Mark 4 was retired and Davis bought a ZX-80. That machine was a great step forward and while being comparatively slow it had a resident Basic which was the forerunner of the Sinclair Basic used today.

Commercial programs were written which heralded the tremendous range now available for Sinclair machines. Davis' latest machine is the Spectrum. He reckons he would have had to pay several thousand pounds for a machine of similar capability when he started four years ago — such is the unparalleled progress in computing hardware.

CLUB BENEFITS

Bi-monthly club cassette available to all members.
Special discounts on hardware, software and books.
Members recover their membership fee many times over.
Free Club software.
Machine code teach-in.
Telephone Helpline.
Technical advice.

Best-seller bargains

THIS MONTH the Club can offer even more in the way of software and hardware. The classic game **Manic Miner** and its sequel, **Jet Set Willy** from Software Projects, are just two of the Spectrum bargains. In the former you must guide Willy through a mine shaft, picking up keys from bushes and stalagmites while avoiding robots and aliens. In the latter you must get him past his housekeeper into the master bedroom where he can fall asleep.

Quicksilva offers three new games, including **The Snowman,** a non-violent program in which you must build your friend the snowman. **Blue Thunder,** from Richard Willcox Software, provides an aerial challenge where you must fly your helicopter through the defences of a nuclear power plant and destroy the core.

Finally for the Spectrum, **Postman Pat** and **Laser Warp,** both from Mikro-Gen, provide space and more down-to-earth action for arcade fans.

Sinclair **Vu-File** and **Vu-Calc** are among the software offers for the ZX-81, so that owners of the computer can keep track of their financial situation and store necessary information on computer.

For those ZX-81 owners with leisure in mind, the Club can offer Sinclair **Backgammon, Flight Simulation** and **Chess.**

All the offers can be obtained only by Club members and are available until the end of June. If you are not a member but intend to join this month, you can take advantage of the hardware and software by sending an order form with your membership fee.

CLUB OFFER

	List price	Offer price
Spectrum hardware		
Quickshot Two Joystick	**£10.95**	**£9.95**
dK'Tronics joystick interface	**£12.95**	**£12**
Alphacom printer	**£59.95**	**£55**
Spectrum software		
Manic Miner	**£5.95**	**£4.95**
Jet Set Willy	**£5.95**	**£4.95**
Tribble Trubble	**£5.95**	**£4.95**
3D Ant Attack	**£6.95**	**£5.95**
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Blue Thunder	**£5.95**	**£4.95**
Postman Pat	**£6.95**	**£5.95**
Laser Warp	**£6.95**	**£5.95**
ZX-81 software		
Vu-File	**£7.95**	**£6.95**
Vu-Calc	**£7.95**	**£6.95**
Backgammon	**£5.95**	**£4.95**
Flight Simulation	**£5.95**	**£4.95**
Chess	**£6.95**	**£5.95**

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Which computer do you own?

ZX-81 ☐ Spectrum ☐

Send your coupons to Sinclair User Club, ECC Publications, 196-200 Balls Pond Road, London N1 4AQ. Cheques should be made payable to Sinclair User Club.

Sinclair User Club

Britain

Aylesbury Computer Club: 12 Long Plough, Aston Clinton, Aylesbury, Bucks.

Aylesbury ZX Computer Club: Ken Knight, 22 Mount Street, Aylesbury (5181 or 630867). Meetings: first Wednesday and third Thursday of the month.

Basildon: Roundacre Microcomputer Users' Club. J Hazell, Basildon 285119/416333. Meetings every Wednesday 7.30 to 10.30pm.

Bristol Yate and Sodbury Computer Club: 99 Woodchester Yate, Bristol, BS17 4TX.

Cardiff ZX Club: Steve Smith (0222) 593237 or Mike Hayes (0222) 371732. Meets twice a month.

Colchester Sinclair User Group: Richard Lown, 102 Prettygate Road, Colchester CO3 4EE.

Crewe and Nantwich Computer Users' Club: J E A Symondson, 46 London Road, Stapeley, Nantwich, Cheshire CW5 7JL.

Doncaster and District Micro Club: John Woods, 60 Dundas Road, Wheatley, Doncaster DN2 4DR; (0302) 29357. Meetings held on second and fourth Wednesday of each month.

Eastwood Town Microcomputer Club: E N Ryan, 15 Queens Square, Eastwood, Nottingham NG16 3BJ.

Edinburgh: Edinburgh Home Computing Club. John Palmer (031 661 3183) or Iain Robertson (031 441 2361).

EZUG-Educational ZX-80–81 Users' Group: Eric Deeson, Highgate School, Birmingham B12 9DS.

Furness Computer Club: R J C Wade, 67 Sands Road, Ulverston, Cumbria (Ulverton 55068). Meets every other Wednesday.

Glasgow ZX-80–81 Users' Club: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow G76 7LW (041 638 1241). Meetings: second and fourth Monday of each month.

Gloucester: Mid-weekly Spectrum User Group. Barry Ledbury, 8 Linnet Close, Gloucester GL4 9XA (0452) 23186.

Gravesend Computer Club: c/o The Extra Tuition Centre, 39 The Terrace, Gravesend, Kent DA12 2BA. Bi-monthly magazine and membership card.

Hassocks ZX Micro User Club, Sussex: Paul King (Hassocks 4530).

Inverclyde ZX-81 Users' Club: Robert Watt, 9 St. John's Road, Gourock, Renfrewshire PA19 1PL (Gourock 39967). Meets every other Monday at Greenock Society of the Deaf, Kelly Street, Greenock.

Keighley Computer Club: Colin Price, Redholt, Ingrow, Keighley (603133).

Lambeth Computer Club: Robert Barker, 54 Brixton Road, SW9 6BS.

Liverpool ZX Club: Meetings every Wednesday 7pm at Youth Activities Centre. Belmont Road, Liverpool 6. Details from Keith Archer, 031-236 6109 (daytime).

Manchester Sinclair Users' Club: Meets every Wednesday, 7.30pm, at Longsight Library, 519 Stockport Road, Longsight — 061-225 6997 or 061 445 6316.

Meopham: National ZX Spectrum User Club. Guy Fullalove, Woodcotes, Camer Park, Meopham, Kent DA13 0XS. Bi-monthly newsletter, subscription £1.50. Send SAE for details.

Merseyside Co-op ZX Users' Group: Keith Driscoll, 53 Melville Road, Bootle, Merseyside L20 6NE; 051-922 3163.

Micro Users' Group: 316 Kingston Road, Ewell, Surrey KT19 0SY.

Mid-Kent Micro Club: Meets once monthly. Enquiries to M Gates, 65 Buckland Road, Maidstone ME16 0SH.

Newcastle (Staffs) Computer Club: Meetings at Newcastle Youth and Adult Centre, Thursday, 7.30. Enquiries to R G Martin (0782 62065).

North Hertfordshire Home Computer Club: R Crutchfield, 2 Durham Road, Stevenage; Meetings: first Friday of the month at the Settlement, Nevells Road, Letchworth.

Northern Ireland Sinclair Users' Club: P Gibson, 11 Fitzjames Park, Newtownards, Co Down BT23 4BU.

North London Hobby Computer Club: ZX users' group meets at North London Polytechnic, Holloway Road, London N7 Monday, 6pm.

Nottingham Microcomputer Club: ZX-80–81 users' group, G E Basford, 9 Holme Close, The Pastures, Woodborough, Nottingham.

Orpington Computer Club: Roger Pyatt, 23 Arundel Drive, Orpington, Kent (Orpington 20281).

Perth and District Amateur Computer Society: Alastair MacPherson, 154 Oakbank Road, Perth PH1 1HA (29633). Meetings: third Tuesday of each month at Hunters Lodge Motel, Bankfoot.

Regis Amateur Microcomputer Society: R H Wallis, 22 Mallard Crescent, Pagham, Bognor Regis, West Sussex PO21 4UU.

Roche Computer Club: 8 Victoria Road, Coop Rooms, Roche, Cornwall: 0726 890473. Twice weekly meetings, Monday and Friday.

Scunthorpe ZX Club: C P Hazleton, 26 Rilestone Place, Bottesford, Scunthorpe; (0724 63466).

Sheffield: South Yorkshire Personal Computing Group. Enquiries to R Alderton (0742 20571), S Gray (0742 351440), P Sanderson (0742 351895).

Sinclair Amateur Radio User Group: Send SAE or two IRCs for details. Paul Newman G4 1NP, 3 Red House Lane, Leiston, Suffolk IP16 4JZ.

Sittingbourne: Anurag Vidyarth (0795 73149). Would be interested to hear from anyone who wants to start a club near the Medway towns.

St Albans: Bi-monthly meetings and a magazine. Details from Adam Slater, 40 Watford Road, St Albans, Herts AL1 2HA. (0727 54176).

Stratford-on-Avon Computer Club: Meets on the second Wednesday of every month. Telephone: 0789 68080 for details.

Swansea Computer Club: B J Candy, Jr Gorlau, Killay, Swansea (203811).

Swindon ZX Computer Club: Andrew Bartlett, 47 Grosvenor Road, Swindon, Wilts SN1 4LT; (0793) 3077. Monthly meetings and library.

Sutton: Sutton Library Computer Club, D Wilkins, 22 Chestnut Court, Mulgrave Road, Sutton, Surrey SM2 6LR.

West Sussex: Midhurst and District Computer User Group. Enquiries to V Weston (073 081 3876), R Armes (073 081 3279).

Worle Computer Club: S W Rabone, 18 Castle Road, Worle, Weston-super-Mare BS22 9JW (Weston-super-Mare 513068). Meetings: Woodsprings Inn, Worle, on alternate Mondays.

ZX-Aid: Conrad Roe, 25 Cherry Tree Avenue, Walsall WS5 4LH. Please include sae. Meetings twice monthly.

Overseas

Austria: ZX User Club, Thomas Christian, c/o Wissenschaft Forscht e. V., Postfach 141, A1190 Vienna. Meets every first Friday of the month. Telephone 0222-44 32 050 for details.

Belgium, France and Luxembourg: Club Micro-Europe, Raymond Betz, 38 Chemin du Moulin 38, B-1328 Ohain, Belgium (32/2/6537468).

Denmark: Danmarks National ZX-8081 Klub (DNZK), Jens Larson, Skovmosevej 6.4200 Slagelese, post giro 1 46 24 66.

ZZ-Brugergruppen i Danmark, Boks 44, 2650 Hvidovre, Gratis medlemskab og gratis blad til enhver interesseret.

J Niels-Erik Hartmann, OZ-ZX-Radioamator, Bruger Gruppe, Bredgade 25 DK-4900, Nakskov.

East Netherlands: Jonathon Meyer, Van Spaen Straat 22,6524 H.N. Nijmegen; (080 223411).

Germany: ZX Club, a postal club; contact Aribert Deckers, Postfach 967, D-7000 Stuttgart 1, West Germany.

Indonesia: Jakarta ZX-80/81 Users' Club, J S Wijaya, PO Box 20, Jkukg, Jakarta, Utara, Indonesia.

Irish Amateur Computer Club: Martin Stapleton, 48 Seacourt, Clontarf, Dublin 3. (331304).

Irish Sinclair Users Club: PO Box 1238, Dublin 1. Publishes a newsletter. Send SAE for details.

Italy: Sinclair Club, Via Molino Vecchio 10/F, 40026 Imola, Italy.

Genova Sinclair Club; Vittorio Gioia, Via F Corridoni, 2-1, telephone 010 3125 51.

Micro-Europe: Belgium or Club Paris-Micro, 19 Rue de Tilly, 92700, Colombes, France; associated with Club Micro-Europe.

Republic of Ireland: Irish ZX-8081 Users' Club, 73 Cnoc Crionain, Baile Atha, Cliath 1.

Singapore: Sinclair Users' Group: Eric Mortimer, 1D Wilmer Court, Leonie Hill Road, Singapore.

South Africa: Johannesburg ZX-80–81 Computer Users' Club: S Lucas, c/o Hoechst SA (Pty) Ltd, PO Box 8692, Johannesburg.

Johannesburg ZX Users' Club: Lennert E R Fisher, PO Box 61446, Marshallstown, Johannesburg.

Dumont and Syndercombe Amateur Computer Club. Jean-Pierre Dumont would like to correspond with ZX-81 owners via tapes. Write to 8 Kipling Road, Farrarmere, Benoni 1500, Transvaal.

ZX SA Club: Jonathan Jones, House 14, Anglo Alpha PO Box 15, 1725 Roodepoorf.

Spain: Club Nacional de Usuarios del ZX-81, Joseph-Oriol Tomas, Avda. de Madrid, No 203 207, 10, 3a esc. A Barcelona-14 Espana. International ZX Spectrum Club: Gabriel Indalecio Cano, Sardana, 4 atrico 2a, San Andres de la Barca, Barcelona. Send international reply coupon. Produces a bi-monthly magazine. Spanish ZX Micro Club: Apartado 181, Alicante (Costa Blanca), Spain.

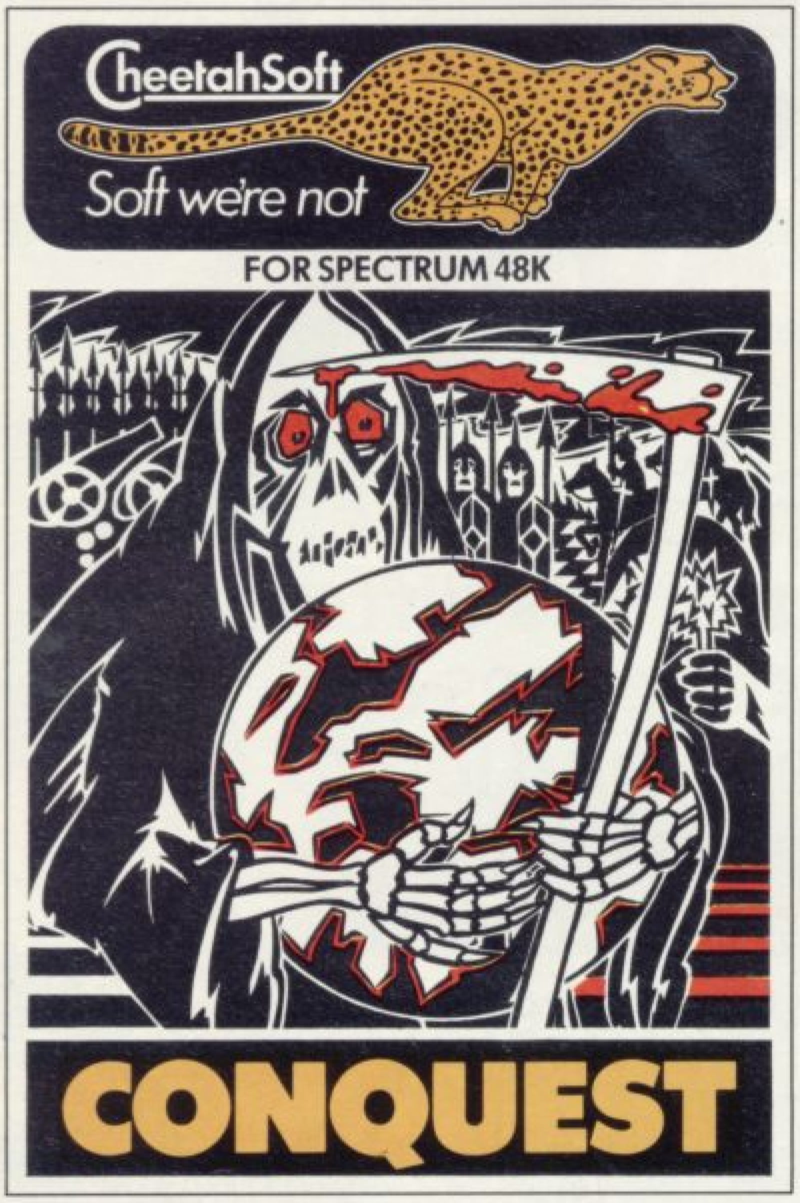
ZX Club Spain; C Benito PO Box 3253, Madrid, Spain.

Swedish ZX-club: Sinclair Datorklubben, Box 1007, S-122, 22 Enskede.

United States: Bay Area ZX-80 User Group, 2660 Las Aromas, Oakland CA94611.—Harvard Group, Bolton Road, Harvard MA 01451: (617 456 3967).

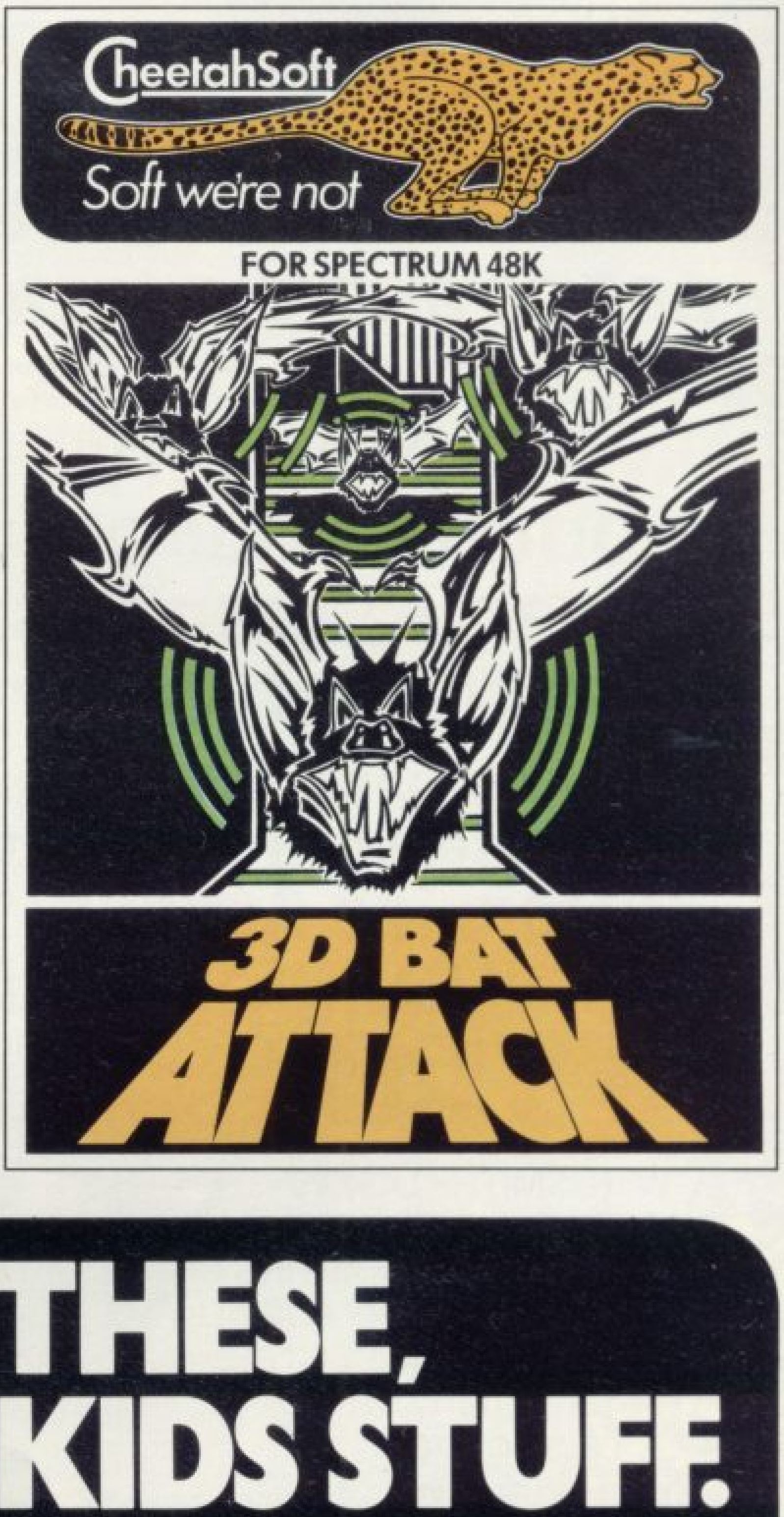


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4 levels of skill. At each level the game gets faster and more complicated, and the vampires more dangerous.



CONQUEST A tactical game which even veteran players will find both challenging and rewarding.

Mediterranean Europe is divided into grid squares. Your aim, as Emperor, is to gain 100 squares of territory as quickly as possible – at the same time dealing with Barbarian counter-attacks, plagues, civil war and rival Emperors.

5 levels of skill, plus a continuous 'Conquest' game where all the difficulty levels are thrown in together.

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So don't play unless you're ready to play the game for real. Because you'll find there's one sure thing about CheetahSoft: Soft we're not.

CheetahSoft

Soft we're not

£6.95 at all good stores.

The winning answers that prove to be educational

WINNERS of the Micro Master and *Sinclair User* Competition were Andrew Trowbridge, Manor Farm, Dorset; Mrs A Ledger, Erdington, Birmingham; C Jackson, Formby, Liverpool; O Dunn, Poplar, London; and J Penn, Huddersfield, Yorkshire.

The correct answers to the questions were MICrocOMPuteR, siLIcoN cHIp, edUcaTIonaL SofTware, MacHine coDE, CliVe sinClair. The most popular anagram from the word SPECTRUM was CRUMPETS.

Each of the winners will receive £25 worth of educational software from Micro Master.

Intelligent Algernon gives the answers

A NUMBER of points were made to us about 'Thinking of Algernon' in last month's issue.

The corrections to the program listings are:

```
75 PRINT Q$: IF N<2
  THEN GOTO 125
125 LET D=M+N
100 INPUT "Press EN-
  TER for my move"; R$
```

Sinclair announce QL Mark Two

THE QL bears little resemblance to the machine launched in January.

It now has an EPROM which contains part of the operating system sticking out of the ROM socket at the back of the computer. The code would not fit into the planned 32K so the designers had to include an extra 16K ROM. Customers who receive the first production machines will not be able to use the ROM socket until they return their machines for an on-board upgrade.

As a result of the upgrade Sinclair has been able to incorporate turtle graphics commands into SuperBASIC. The language also has been changed which means the manuals, currently at the printer, are incorrect. The hardware, too, has been altered. The battery clock will not appear on any model.

Asked whether the machine showed to journalists would be the same in six months a spokesman for Sinclair declined to comment.

The company nevertheless hopes that deliveries of the QL will soon be under control. It has promised that all dates given to customers will be fulfilled but has refused, however, to confirm the dates for deliveries.

The company has stated that it will be including an RS-232 cable in every QL order for customers who have experienced delays and whose money is in a holding account until deliverie

Providing Hobbit help

THE SUCCESS of **The Hobbit** adventure game for the 48K Spectrum has prompted Melbourne House to publish a book giving a solution to the game called *A Guide To Playing The Hobbit.*

It is divided into three sections. The first provides general strategies and tactics to be used, the second and third offer detailed solutions. A spokeswoman for the company says:

"The book provides only one solution to The Hobbit, so you can play through it and solve it using that guidance. There is, of course, more than one solution so the book does not spoil the game for the player. The user will still be able to explore other ways of completing The Hobbit."

The Guide costs £3.95. More information can be obtained from Melbourne House, Castle Yard House, Castle Yard, Richmond TW10 6TF.



VTX modem is offered by Prism

PRISM Microproducts has announced a special offer through which Spectrum owners are given a VTX 5000 modem, one year's subscription to Micronet and Prestel, free user-to-user software and quarterly hardware and software discounts — all for £11 a month. In the second year the subscription falls to only £20 a quarter.

The scheme is expected to provide a much-needed boost to Micronet membership as it enables users to join who previously found the cost prohibitive.

Imagine increase

IMAGINE SOFTWARE has increased its prices to £5.50 again in an amazing turnround in marketing strategy. Within two weeks of reducing prices to £3.95, the company was under attack from retailers who would have lost profit. Threats were made not to stock Imagine games.

Now it appears that Imagine has bowed to the pressure and agreed that it is the dealer, and not the customer, who is always right.

Meanwhile Studio Sting, the Imagine advertising agency, has gone into liquidation. The company, in which Imagine directors Mark Butler and David Lawson held shares, was set up to cover art and promotions. Reasons for liquidation include a suggestion by the company that Imagine owes it a substantial amount of money, a claim which Imagine disputes.

more news on page 15

Top Ten

Program	Last month	Company	Memory
1 Atic Atac	2	Ultimate	48K
2 Lunar Jetman	4	Ultimate	48K
3 Ant Attack	6	Quicksilva	48K
4 Chequered Flag	1	Psion	48K
5 Jet Set Willy	—	Software Proj.	48K
6 Scuba Dive	7	Durrell	48K
7 Pogo	—	Ocean	48K
8 Bugaboo	—	Quicksilva	48K
9 Jetpack	—	Ultimate	48K
10 Flight Simulation	3	Psion	48K

Figures supplied by W H Smith.

Micro sales double as the market booms again

HOME COMPUTER ownership has more than doubled in Britain in the last year and looks set for more growth in 1984, according to a survey published by Gowling Marketing Services of Liverpool.

More than one home in 10 had a computer last January, which is more than 11 percent compared to 4.9 at the same time last year.

The report states that last year market growth exceeded all projection but the signs are that after 1984 the hardware market will enter a maturity stage and growth will begin to slow.

Sinclair Research and Commodore dominate the hardware market and the top six models account for 87 percent of computers in use. The report states that it is difficult to see any long-term future for less popular models or for new entrants unless they can offer some important advantage.

Despite the gloom on the hardware front, prospects are bright for software. The industry looks set for its best year ever, with arcade and adventure games likely to take 70 percent of total sales.

More information about the survey can be obtained from Gowling Marketing Services Ltd, Britannia Buildings, Fenwick Street, Liverpool L2 7NA.

Search for the ultimate game

YORKSHIRE Television and a new company, Ventech, have launched into a venture to take interactive computer arcade games to the television screen. The signals from a video game will be merged with studio film and pre-shot locations so that viewers will see a 'believable arcade game' using real characters and backgrounds, which will also have a plot which viewers can follow.

The pilot episode of the new series of television programs was filmed in January and will never be seen by the public. It was called *Quest For Abigail,* which bore some resemblance to the quest for the Holy Grail, and for which Insight Software prepared an adventure game to fit around the plot.

The shows will feature computer games for which Yorkshire and Ventech are to market the software.

The advent of *The Game* has set independent television thinking even more seriously about the development of computers on television. One idea is to have a limited version of a multi-player arcade game where each player has a television set and a control keyboard or joystick with which to play the game from home. The techniques used would follow from those used by Prestel and Micronet 800.

The independent networks are also thinking about having a microcomputer compete with the BBC microcomputer.

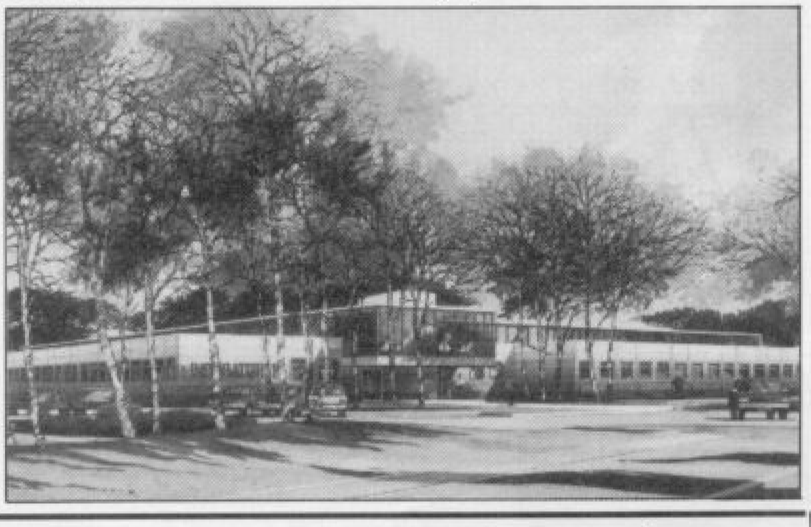
Suggestions which have been made are that the companies use either the Wren business system from Prism Business Computers or the Sinclair QL.

Independent television has yet to decide.

Sinclair wheels in new car base

SINCLAIR VEHICLES Ltd, the company which is to produce Sir Clive Sinclair's first commercial electric car, has moved to new headquarters at the University of Warwick Science Park.

Staff at the new centre will concentrate on the development and marketing of a family of vehicles which, Sinclair says, is due for introduction in the next three to five years.



The first of the new electric vehicles will be for low-cost town and commuter use and will be ready in late 1984 or early 1985. Assembly will be sub-contracted to Hoover plc at Merthyr Tydfil. Barry Wills, managing director of Sinclair Vehicles Ltd, says:

"The Science Park is an ideal location for the various research and development facilities in the Midlands. It also enables us at the same time to draw on university expertise in manufacturing, automotive engineering and electric traction."

The company has also been attracted by the expansion potential of the Science Park and expects to move into one of the larger technology units. Science Park director David Rowe says:

"I can think of no better project for the Warwick Science Park. The university has an outstanding history of involvement in the automative industry and the Sinclair style of operation makes it eminently suitable for the Science Park."

more news on page 16

Games firm masters prices

NO SOONER has Imagine announced that it cannot drop its software prices after all, than two new companies launch a number of cut-price games cassettes effectively turning the software market on its head.

From the beginning of April, Pulsonic has been selling its Spectrum games for only £2.95, while Mastertronic has released an extensive range of titles for the Spectrum and the Commodore computers at an unprecedented £1.99 each.

In the past software houses have claimed that prices cannot be lowered if reasonable profits are to be maintained. Frank Herman of Mastertronic disagrees, and says the secret of low pricing lies in direct mass marketing. Mastertronic took more than 100,000 orders in the first week of operation from outlets which included the small independent retailers as well as W H Smith and other major chains.

What is the reaction of the major software houses to this strategy? Herman sums it up precisely: "They hate us."

Prism modem wins award

THE VTX-5000, the Spectrum modem link to Micronet 800, won the Peripheral of the Year prize in the British Microcomputing Awards.

The modem enables Spectrum users to download software from Micronet via the telephone, and was developed by Prism Microproducts. A short time ago the VTX won a RITA Award at the Which Computer? Show.

Zap around the clock

AN ATTEMPT to set a world record for non-stop playing of computer games was linked to a medical research of the craze at a recent computer exhibition. Derek Creasey, a 14-year-old schoolboy from Stockport, aimed to play arcade games for 24 hours while hooked-up to medical equipment which would measure body functions. Mick Cowley, a spokesman for the organiser, Database Publications, says:

"Children all over the country are now playing these games for hours and some people have suggested that it might be creating medical problems for them.

"At the end of 24 hours, we will have a full read-out ready for analysis and will be able to establish whether or not the current craze is potentially dangerous as some people suggest."

Unfortunately Creasey did not fulfil his ambition to set the 24-hour non-stop record. He fell asleep at the computer 55 minutes before the record would have been set.

New interface ROM

SINCLAIR RESEARCH is to change the ROM in the Spectrum Interface One. According to the company there would be no side effects as a result of the switch. Software which has already been produced to use the interface should not be affected by the change so long as the recommended machine code hook points are followed.

Late last year a change in the Spectrum ULA caused difficulties for some software manufacturers when users found that they could not use certain products with mark three machines.

Sinclair Research anticipates no such difficulties with the modification of the Interface One ROM.

Sinclair software

WEBSTERS SOFTWARE has been appointed non-exclusive U.K. wholesale distributor of software for the ZX-81 and Spectrum by Sinclair Research. The deal will provide a merchandising service to chain stores and computer shops and the first shipments were made at the beginning of April. Anton Boyes, Sinclair retail sales manager, says.

"We wanted to improve the availability of our own-brand software and to give retailers a choice of distributors.

"Software represents an increasingly significant proportion of our business — around eight percent against two percent two years ago — and we aim to increase our share of the Spectrum software market considerably during the next year."

Websters Software Ltd is part of the Websters group, which also includes Felix Learning Systems and Websters book shops.





Still of Buster Keaton from The General © Raymond Rohauer 1984

Try pulling a stunt like this on your Spectrum

Leap on a moving train . . . jump from carriage to carriage . . . duck under fast-approaching bridges.

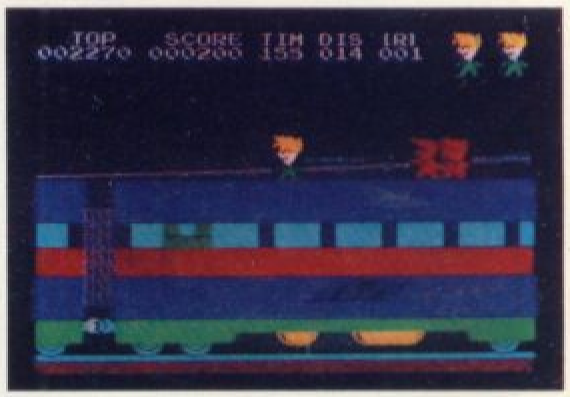
But before you do *anything*, make sure it's with Sinclair's new action-packed game – 'Stop the Express'.

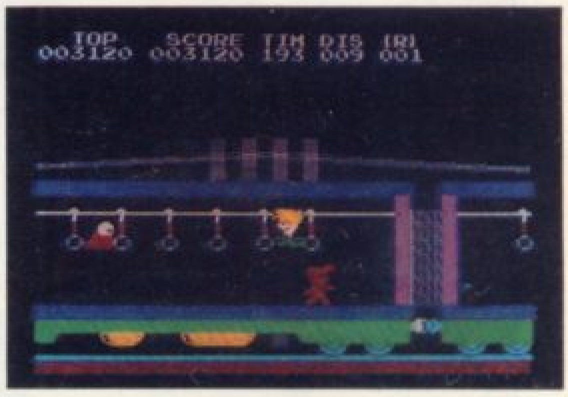
That way, you can try dramatic feats like Buster Keaton's – without risking your neck!

'Stop the Express' is one of five exciting new games from Sinclair. Its graphics are superbly fast and sharp. The action is non-stop. And the challenge is a very tough one.

On top of a racing express, you're chased by knife-throwing bandits. And inside the express, there's even more trouble.

Will you ever get to the front and halt the train? Or will you be well and truly bumped off?





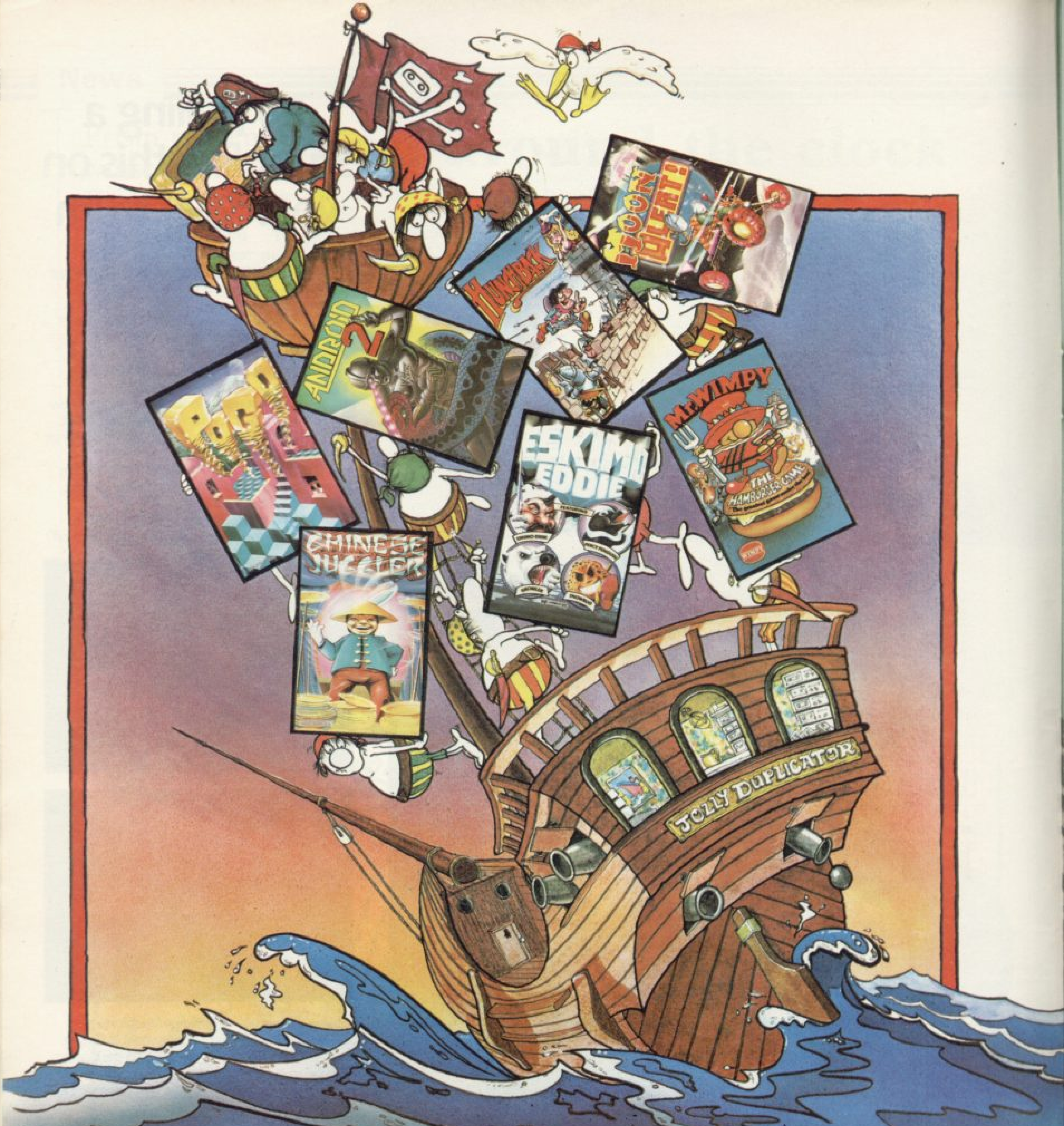
All five new Sinclair titles – Stop the Express, Bubble Buster, Zipper Flipper, Eric and the Floaters, and Driller Tanks – are for a 48K Spectrum. You'll find them in the shops – today.

At only £5.95 each, they're destined to be big stars on the small-screen!

Selected Sinclair software lines are available from W.H. Smith computer stores, larger branches of Boots, John Menzies, Greens and most other software stockists nationwide.

Sinclair Research Ltd, Camberley (0276) 685311.

sinclair



MOON ALERT!
HUNCHBACK
ANDROID 2
POGO
ESKIMO EDDIE
Mr.WIMPY
THE HAMBURGER GAME
CHINESE JUGGLER
JOLLY DUPLICATOR

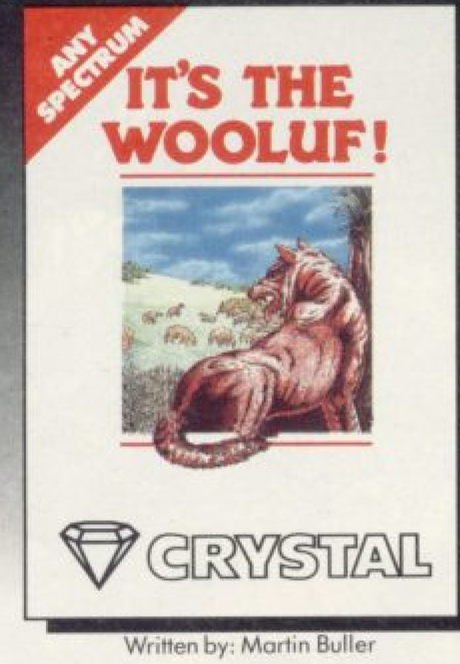


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TWO NEW RELEASES FROM CRYSTAL

IT'S THE WOOLUF!

TUBE WAY ARMY



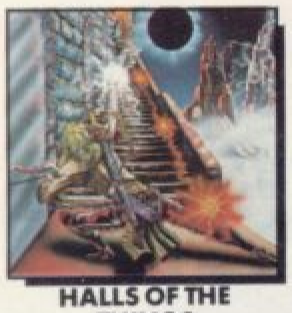
Written by: Martin Buller



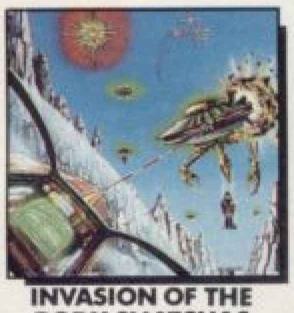
Written by: Rainbow Software

From the creators of 'Halls of the Things,' 'Invasion of the body snatchas,' and many other software classics come these exciting new games. Games to tax your judgement and puzzle and frustrate you for months on end. Don't forget our other titles, which have attracted enthusiastic reviews like "Spectacular, one of the best games I've seen"... POPULAR COMPUTING WEEKLY and "Excellent, dangerously addictive, could change the Spectrum games scene overnight" ... SINCLAIR USER.

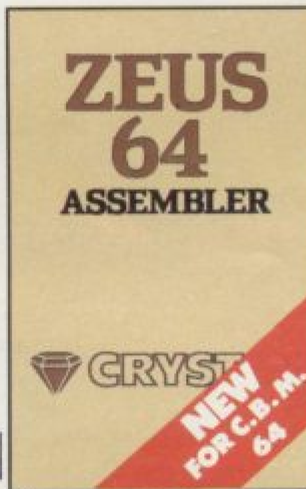
COMING SOON RETURN OF THE THINGS



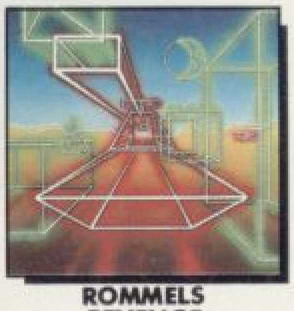
HALLS OF THE THINGS
Written by: Neil Mottershead, Simon Brattel and Martin Horsley



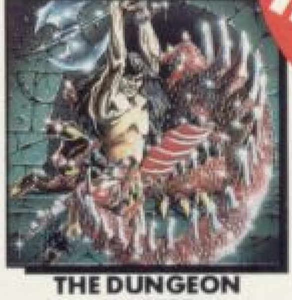
INVASION OF THE BODY SNATCHAS
Written by: Simon Brattel and Neil Mottershead



Written by: Graham Stafford



ROMMELS REVENGE
Written by: Martin Horsley



THE DUNGEON MASTER
Written by: Graham Stafford

All titles for 48K Spectrum unless otherwise stated

PROGRAMMERS! WRITTEN ANY SOFTWARE THAT COMES UP TO OUR STANDARDS? IF SO SEND IT TO US FOR EVALUATION. WE OFFER GENEROUS ROYALTIES.

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SU/6

Sinclair service record

IS IT really the big demand for the QL which is causing the delays in delivery? If that were true, those orders which were within the estimated demand would have been met and there would be a number of QLs in the hands of users.

When my order was placed I was assured that delivery would be within 28 days; 14 days later I was advised, in writing, that the order was being processed for delivery, but the day after delivery should have been made I was informed, in writing, that delivery would be delayed until the end of June.

It would seem that Sinclair is somewhat careless concerning contracted obligations. If Sinclair is to be considered as trustworthy, it should be more forthcoming with information which must be accurate and credible.

Sinclair service is appalling. My Spectrum has been replaced several times and on the most recent occasion the need was very urgent but Sinclair refused to speed the extremely slow turnround time in its workshops; it would have paid me to have had the job done at an independent workshop.

After the Spectrum was eventually returned it was discovered that the Microdrive and Interface 1 had more bugs than a hedgehog's skin; again, help from Sinclair was conspicuous by its absence.

The RS232 interface, part of Interface 1, is sending out spikes which upset the printer and the Microdrive snatched an almost completed tape out of the cassette and wound it round the mechanism; then I discovered that tapes processed on one Microdrive are not compatible with tapes loaded on another Microdrive — there seems to be a speed differential between different Microdrives. In a telephone conversation, a representative of Sinclair denied the possibility. Letters to Sinclair have not been answered, including a recorded delivery letter to Nigel Searle.

In the last two months my Spectrum, Interface 1 and Microdrive have cost more than the original purchase price of the equipment and caused considerable problems. My son was unable to submit his A level examination project by the due date and as a result may be unable to enter the A level computer studies examination this year. That is a most appalling consequence of using Sinclair equipment.



The QL seems to have generated a lot of interest . . .

The Sinclair products are innovative and meet a particular market need and the QL would seem to be following that tradition but unless Sinclair puts its service department in order and tells the truth about broken contracts to supply QLs, it will eventually go into well-deserved oblivion. It is no wonder that foreign countries are making substantial inroads into British manufacturing and service industries.

John Cargill,
Southport.

The long view

AS A ZX-81 owner for only four months I have noticed a fair sprinkling of complaints letters, aimed chiefly at the poor reliability record and poor back-up provided by Sinclair.

What long-term international future can there be for a firm with a questionable record of quality control? When the Japanese enter our market seriously I suspect many will feel a cold wind blow. My next computer may not be a Sinclair, despite my complete admiration for the capabilities and potential of my little ZX-81, simply because of mixed reliability and dismal service.
service.

Sir Clive Sinclair is often quoted as saying that once a product is launched he loses interest in it. That is a dismissive insult to those who have placed their faith in his products. In an ever more competitive market that can only be described as a 'head-in-the-sand' attitude which has often led to U.K. firms losing valuable markets. To maintain the ZX-81 as the best beginners' micro I would add three modifications — some kind of colour capability; a revised keyboard — nothing too special, my Filesixty stick-on job is admirable and cheap; and Microdrive compatibility. The Spectrum does not need much work on it; just more quality — that word again — and a decent keyboard. If Oric can do it and Timex can do it, why can't Sinclair?

The QL? Surely Sinclair has lost goodwill by marketing a machine which seems to be non-existent; not having the specification finalised at the launch; taking money without being able to provide the goods in the 28 days stipulated.

Like most readers of your magazine I would like Sinclair to be world-beaters and to remain world-beaters for years. That will not happen unless fundamental flaws in its operation are set to rights and only pressure from you and the customers can tell it when change or improvement is required.

T P Hancock, Leeds.

How many days make 28?

I HAVE been a reader of your excellent magazine for 18 months and owner of a Spectrum for 15 months. Your March magazine had an article entitled, QL demand . . . delays. That is an understatement. Within a day of Sir Clive's statement launching the QL I telephoned to order it. Three days later I paid £407 for it — I did not know about the QLUB then. My cheque was cashed on February 1 and my VAT receipt dated February 13. I am still waiting. I understand no QLs have been despatched.

Yet in the advertisement/order form it stated "Despatched within 28 days of your order." After endless telephone calls to Camberley and three letters to top management, all of which have failed to generate a response, I write hoping you can get a satisfactory answer from Sinclair Research. I even have a computer printed postcard dated February 7 saying "your (QL) is being prepared for despatch." So much for computers.

Previously I waited patiently for 13 months for two Spectrum Microdrives. When they arrived nobody even said sorry.

Robert Macmillan,
Southampton.

more letters on page 23

the LLAMA has LANDED!

...... and it's breeding fast.

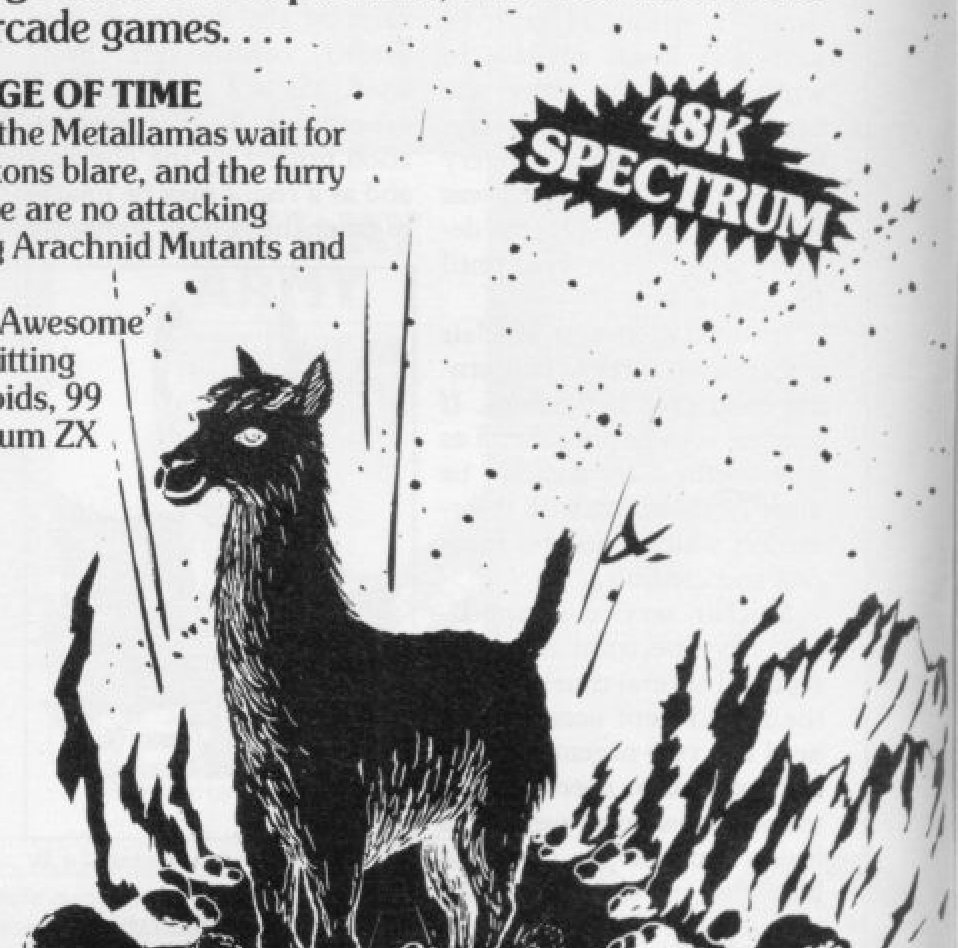
Once upon a time, only Commodore owners could experience the thrill of playing an original game by Jeff 'Awesome' Minter. Lesser mortals could only sit and stare in wonderous rapture at the furry arcade action brought to you by Llamasoft.

BUT NOW THERE IS HOPE.

Dragon owners were the first to see the light of day, but now Salamander Software is pleased as punch to announce that selected titles

ARE NOW AVAILABLE FOR THE 48K SPECTRUM.

Yes that's right, Salamander is now producing titles for the Spectrum, and the first of these are two great arcade games....



METAGALACTIC LLAMAS BATTLE AT THE EDGE OF TIME

On a forlorn observation post at the edge of the galaxy, the Metallamas wait for a sign of Zzyaxian spaceships. Suddenly the alarm claxons blare, and the furry friends of freedom rush to the fore only to find that there are no attacking spaceships, and that they are under attack from Cyborg Arachnid Mutants and Disgusting Weeviloids....

This classic arcade game, originally developed by Jeff 'Awesome' Minter of Llamasoft, features 1 and 2 player options, spitting Llamas, Cyborg Arachnid Mutants, Disgusting Weeviloids, 99 levels of play. Joystick recommended. Supports Spectrum ZX Interface 2 and Kempston joysticks.

MATRIX: GRIDRUNNER II

It is ten years after the infamous Grid Wars, and humanity is once again threatened by the evil droids, only this time they're back in force with new weapons and new allies.

The awesome sequel to the best selling Gridrunner, Matrix features all the old favourites like Droids and Zappers, but increases the panic quotient by adding Diagonal waves, Cosmic Cameloids, Energy deflexors, the Snitch and more.

Game originally developed by Jeff 'Awesome' Minter of Llamasoft. Joystick recommended. Supports Kempston and AGF joystick interfaces.

In space, only the camels can hear you scream.

What some famous people have said ...

"What's an arcade game	Aristotle
"Awesome"	Jeff Minter
"I prefer elephants"	Hannibal
"Don't shoot me, I'm only the piano player"	Elton John
"Boing"	Zebedee

Please add 50p P.&P. to all orders. Send A5 SAE for full catalogue.

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Salamander SOFTWARE

17 Norfolk Road, Brighton, BN1 3AA. Telephone: (0273) 771942.

48K SPECTRUM TITLES **These titles available through Quicksilva Ltd.*

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DRAGON 32 TITLES Gridrunner £7.95 • Laser Zone £7.95

GSH

SELECTED TITLES AVAILABLE FROM: John Menzies WHSMITH Boots

Politics and Sinclair User

AS A TEACHER and a Conservative supporter, I take exception to some of the remarks made in your April article, No Time For Complacency. I cannot speak for the present Government but I would like to put my views as briefly as I can.

The profligate spending of the last Socialist Government, or "Labour" as it calls itself, for some unknown reason, left this country in a very difficult financial position. The International Monetary Fund had refused to lend it any more money because of the extravagant way in which it was spent and the Socialists had to impose a freeze on spending which affected education and other services very severely.

It has cost practically all the revenue from North Sea oil to pay the interest on that debt and pay off some of the blank cheques left behind when they were put out of office in 1979. Under their Minister of Education, none other than Mrs Shirley Williams who was then a Socialist, we suffered equally from shortages of books and materials at a time when schools were full. She was too busy trying to impose comprehensive education on all and sundry to bother about such mundane things.

The present Government has put things back into perspective. You just cannot go on spending other people's money for ever, soaking the "rich" — who are usually not Labour supporters — to give to those they consider are the "poor" — who are usually good Labour party members, otherwise they do not exist — forever. What happens when there are no more "rich"?

I bought a 48K Spectrum last July after a long wait until I could afford one, as I wanted to assess its capabilities as a teaching machine, which I found to be limitless. I also wanted to keep one step ahead of the little horrors I teach and to be able to hold my own in discussions. As I find it a pleasant relief from work and politics, I did not welcome the intrusion of this in your otherwise excellent magazine. I shall, of course, continue to read it, despite all.

I cannot afford many things just now, like a daisy-wheel printer to go with my Tasword II and replace my 30-year-old typewriter; I shall buy one when I can afford it. The Government would dearly love to issue each school with two dozen computers and keep them up to date but there is the debt to pay and all manner of pressure groups demanding their share of public funds which are only just beginning to exist again.

J R Murray-Bligh,
Formby, Liverpool.

• *The article discussed the speech made by the Junior Industry Minister, Mr John Butcher, in which he claimed the present Government has established a 'world lead' in educating the first generation of computer-literate school children. In view of the inadequate computer resources in today's schools, that claim should not be allowed to pass unchallenged.*

Running into problems

IN THE GAME Cross Country in the April issue there is a mistake at line 30. It should read "PRINT AT 21, INT (RND * 32)", not "AT 21, INT (RND * 31). As the game is printed you can move the runner to column 31 and so avoid all the cows without moving again.

John Coulthard, aged 8,
Newcastle-on-Tyne.

Sadistic games

IN REPLY to the letter from John Cockbill I regret to inform him that I, and probably many other readers, including the seven-year-old son of one of my friends, escaped from Atic Atac many months ago.

Aficionados of the game should not be misled by the clues he has given as the location of some of the door keys varies between games.

For a test of real skill I suggest the game designed by a sadist for play by masochists, i.e., Chuckie Egg. Levels 1-8 are comparatively easy and levels 9-16 where one has only to cope with the mad duck are also plain sailing. Levels 17-32 involving chickens and the mad duck are slightly more difficult.

The really sadistic element, however, appears at level 33, where the format is the same as for the previous eight levels but the speed of the chickens is increased. The main disadvantage to the game is the inability to save a successful run and as it takes me more than an hour to reach my current limit of level 40, I suffer from lack of practice at high speeds. Is there life beyond level 40?

Harry Leeson,
Broxbourne, Herts.

So simple

IN REPLY to John Cockbill — April issue — sadly he did not make history by cracking Atic Atac. I cracked it in 1983 — it was so simple I did not consider it worth writing about.

J B Cole,
Salisbury.

Adventure helpline

I WRITE to inform you of an adventure helpline club I have started. I would be grateful if you could inform your readers of it. If any reader wishes to join they can contact me for more information.

Christopher Tihanyi,
2 Victoria Square,
Clifton, Bristol 8.

Do not adjust your set?

I AM WRITING with reference to a problem one of your readers had with obtaining colour from a Spectrum on a Contec 14in. portable TV.

First remove the five screws from underneath the Spectrum casing and turn the computer upright. Then carefully lift the top part of the casing so that it is just clear of the circuit board. Move it down over the rest of the casing but do not stretch the keyboard ribbon cable. Between the ULA and PAL encoder are four adjustable screws, used to tune the two separate outputs of the ULA. Then connect the computer to the TV as normal and create a border and paper colour. It is important that you note the positions of the screws mentioned. Use a screwdriver to adjust the top three of those screws until the colours appear on the TV, starting with the resistor marked 2.2 Kr. If after a time the colour disappears, further adjustment is needed. The bottom screw may also be adjusted if necessary. If that method fails, return the screws to their original positions.

G. Saunders,
Southampton.

• *We remind readers that if a computer is still under guarantee, operations such as those suggested will invalidate the guarantee. If in doubt, consult your local dealer.*

more letters on page 24

The house is bugged

I HAVE managed recently to get my hands on a copy of the long-awaited Jet Set Willy. This game struck me as an example of the very finest games design possible and is a good target for other software houses but I was rather annoyed to find that there are one or two severe bugs in it.

After playing the game for some time I found a room by the name of "Dr Jones will never believe this".

From the time I left the room I found that unusual things began to happen in certain rooms. For a start, all the nasties in the chapel disappeared, the UFO in the bridge disappeared, and if you enter either the kitchen or the east wall base or inside the mega trunk one by one all your lives disappear.

Another rather less cataclysmic bug is that when on the rope hanging over the beach, if you swing until the rope is at full swing and then jump off, so that you hit the top of the screen, you suddently re-appear half way under the sand. Surely this could be corrected?

Of course, I realise that Matthew Smith was under tremendous pressure to release the game and far be it from me to criticise someone of his skill and talent for writing brilliant games, but I think I would rather have waited a few more weeks for the builders to finish Willy's mansion before I bought it.

Joseph Robson, Sheffield.

Baddies are sdrawkcab

IN THE MARCH issue, a review of 3D Seiddab Attack from Hewson Consultants was given in Software Scene. The question was posed as to what Seiddab(s) are, as the game requires the commander to shoot them down.

I suggest you try reading the word backwards which may answer your question.

Neil Cowlishaw, Bicester, Oxon.

Good service at a price

RECENTLY I had problems with my computer caused by a faulty interface and the slot bar was missing. It caused a series of faults which rendered the computer useless. Feeling depressed, I posted my Spectrum to a repair company on a Monday and had it back in good working order the following Friday, for £16.10 inclusive.

I am sure most readers would benefit from the peace of mind of knowing that such good service is available. The company is Computa-Fix, Unit 2B, Albany Park, Frimley, Camberley, Surrey. Telephone 0276 66266

A F Anslow, Willingdon, Sussex.

Yes, another program bug

I HAVE been buying *Sinclair User* for the last few months and I have found it very enjoyable to read and to test the programs but in the February edition I found in the program Starship Epsilon a number of mistakes.

On line 1525 it stated Print "(33*ISP)" and it should have read Print "(32*ISP)" also inverted commas were missed at the end of the statements.

Ian Marshall, aged 12, Daventry.

The Puzzle of the Pirated Software

The solution to the mystery published in the April issue

LATER THAT DAY, after the police had arrested the hapless Terry Dactill, Sherlock Holmes elaborated on his chain of reasoning.

"This morning, when Penny Traitor gave Dactill the cassette of **Lord of the Rungs** to load into the Spectrum, he made no attempt to switch it on. His first action was to rewind the tape. That was inconsistent with his account of the events of the previous evening, in which he stated that he had rewound the cassette before handing it to Mel Bourne and had then unplugged the equipment. It was clear that he was lying.

"The all-important clue, however, was the hi-score chart displayed at the end of the game. The scores themselves were irrelevant, but the surprising fact was that the scores were there at all, as they could not have been an integral part of the original program and would have been lost when the computer was switched off after play.

"It follows that the cassette which was found in the rifled desk drawer was not the original but a copy which had been SAVEd from the Spectrum after the game had been played.

"Let us now imagine the probable sequence of events. Dactill had been approached by Moriarty Micros and paid to steal the game. He assumed that Bourne would lock the cassette in the safe as usual, and the only way he could steal the game was to SAVE it from the computer itself. While the others chatted in Bourne's office Dactill pretended to unplug the equipment, planning to return later.

"He did so that night and immediately SAVEd the game. He then went to Bourne's office and set about faking a break-in. His plan was to create the impression that an unknown agent had forced an entry to the building, ransacked the office, opened the safe and copied the master cassette, finally replacing it in the safe before leaving.

"If suspicion should fall on Mel Bourne, as the only person who knew the combination of the safe, or, indeed, a professional safe-cracker, then all well and good.

"His first mistake, however, was to smash the window from the inside, scattering glass outside on the fire escape. That indicated an inside job, and eliminated Miss Traitor and Horace Goezski as neither had keys.

"To provide further evidence of a burglary Dactill then forced open the desk drawer and found, to his surprise, the master cassette, which he had believed to be in the safe.

"It was then that he made his second error of judgement. He exchanged the cassette for the copy he had made, knowing the quality of the original recording to be superior. He assumed that no-one would notice the substitution, forgetting that the copy would contain the hi-score chart.

"He then left the building, neglecting in his haste to switch off the computer, which explains why it was so hot when I picked it up. Dactill had to rewind the cassette this morning because, as he knew only too well, it was the copied version and not the master cassette. Simple, eh Watson?"

A list of the prize winners will appear next month.

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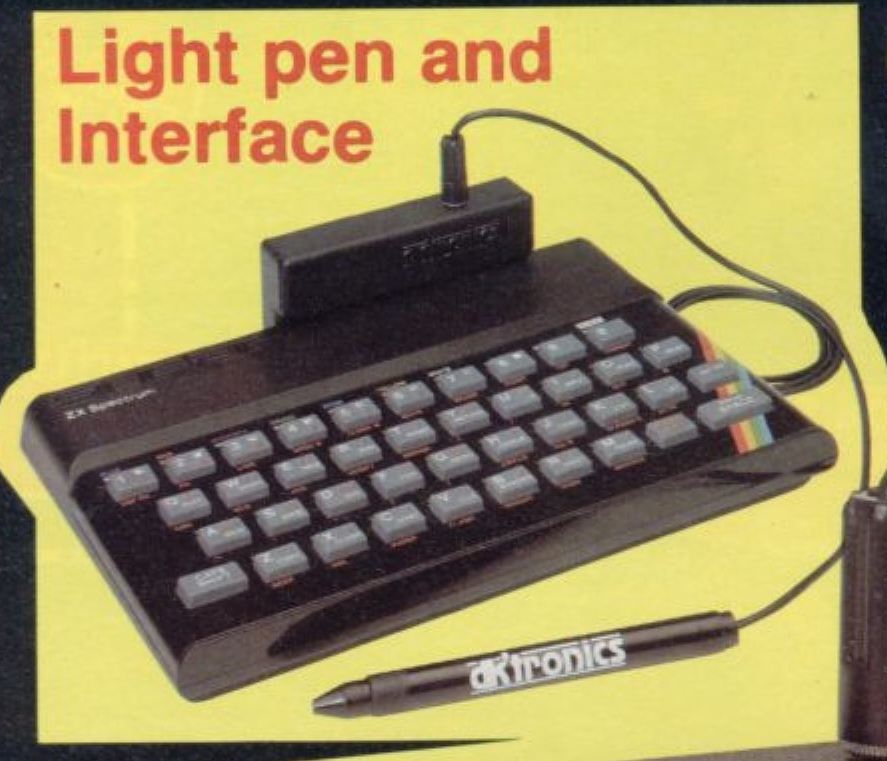
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The Spectrum Connection

New lease of life for graphic designers

THE ORIGINAL Pixel Pad, now marketed by Peter Blanford & Co, has been released again, with versions for the BBC, Spectrum and Commodore 64, along with a new Graphic Grids pack.

The Pixel Pad is the biggest pad available, being 43cm. × 29.5cm. overall. It has a full screen grid, 29cm. × 21.5cm. of 24 lines by 32 columns, each character square being sub-divided into 8×8. Both the character squares and the plot positions are marked. At the bottom of the pad are eight 8×8 grids marked from 1 to 128 for UDGs. At the side is a summary of all the commands you are likely to need.

The Graphic Grids are A5 size and have 16 8×8 grids and a 13×4 screen grid. The pads are aimed mainly at educational users but a 50-sheet Pixel Pad can be obtained from Peter Bamford & Co, 10 Barley Mow Passage, Chiswick, London W4 4PH. Tel: 01-994 6477. It costs £4.95 plus £1 p&p. Graphic Grids are priced at £2.45. They are also available through the Spectrum chain of shops.



To hear is to obey with Micro Command

SPEECH recognition is a growing area of interest and the new Micro Command from Orion Data looks set to help. It is supplied with a microphone and a demonstration tape which allows Spectrum users to teach their computers up to 15 words and then to have words recognised when repeated.

Users of 48K will also be able to play Sheeptalk, a game where the dog is controlled by spoken commands.

Normally, speech recognition for a computer is very expensive; a look inside Micro Command shows why. It contains a Z-80A CPU, as used in the Spectrum, ROM and RAM, buffers and audio circuitry.

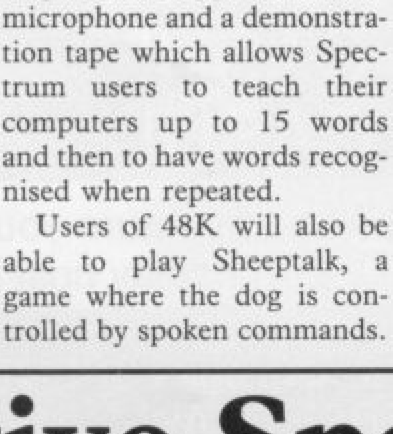
The demonstration tape takes you through the process of learning to use the unit in easy stages. Starting with up and down and then adding left and right it allows you to continue only if you score more than 80 percent. You must pronounce each word very carefully. Once past that stage you can play Sheeptalk. The game, produced originally by Virgin Games, is in Basic and hence fairly slow. It shows the limitations of the unit, as it is difficult to keep the same careful tone when the dog starts driving the sheep into the river.

Included with Micro Command are comprehensive instructions for its use, plus an additional information booklet which lists the basic teaching program and a disassembly of the machine code which is used. It also gives details of the variables used by the code and shows how to include Micro Command in your programs.

Micro Command costs £49.95. That may seem expensive to Spectrum users but considering its contents, the work which must have gone into it, and the price of other similar units, it is reasonable. Orion Data is at 3, Cavendish Street, Brighton, East Sussex BN2 1RN. Tel: 0273-672994.

Executive Spectrum

IF YOU often carry your Spectrum the S1 Computer Case by Treetop Designs could be useful. The case is a standard size, 480mm. × 380mm. × 110mm. executive briefcase with an ABS insert moulded to accept the computer, power supply, Sinclair printer and a cassette deck.



The moulding inclines the Spectrum to a comfortable working angle and includes a small panel which has a LOAD/SAVE switch and a re-set button. When in use the lid of the case can be removed.

The unit ensures that all the leads are out of sight and, when you upgrade your Spectrum by buying an Interface One and Microdrives, you can also obtain a new moulded insert — S2 — to house them.

Both versions of the case cost £47.95 with extra inserts at £15.45 and can be obtained from Treetop Designs, 61, Widmore Road, Bromley, Kent BR1 3AA.

Improved memory for upgrading Spectrums

EAST LONDON Robotics has improved its SP48 kit which upgrades Issue 2 and Issue 3 Spectrums from 16K to 48K. The new kit, SP48b, has been introduced because Issue 3 Spectrums need an additional link to be made on the PCB. The kit includes a small metal clip which solves that problem.

The instructions supplied with the kit are clear and straightforward, most useful being a photocopy of the inside of a Spectrum with the positions of the chips marked and also showing the way they go.

If care is taken, fitting the kit can be attempted by anyone, whether having electrical knowledge or not.

To test the kit fully we obtained a 16K Issue 3 Spectrum and fitted it and, as always seems to happen when a number of people are watching, it did not work. We telephoned the ELR panic number and the problem was easily pin-pointed and a replacement chip sent.

It should be pointed out that the error was not due to ELR but a mis-match between two of the chips.

The offending chip was swapped temporarily with one from another piece of equipment and both worked after the transplant.

Also included with the kit is a free software tape entitled **Beyond Horizons.** It is a very basic program giving a few pointers on how the Spectrum works.

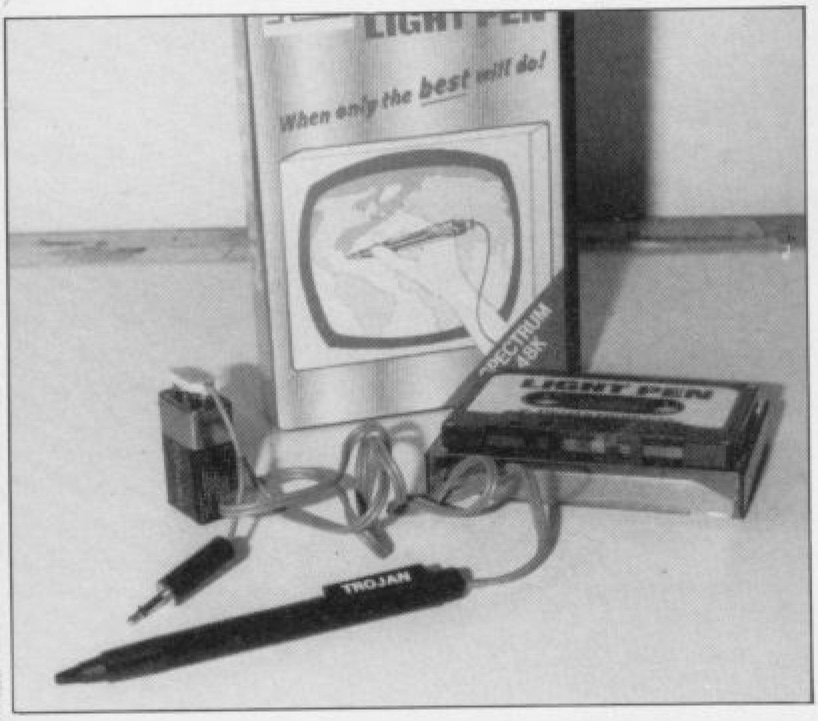
The SP48b costs £23, the kit for Issue One Spectrums is £35 plus 65p p&p, and is available by mail order from East London Robotics Ltd, Gate 11, Royal Albert Docks, London E11. Tel: 01-474 4430.

Trojan pen makes light work

TROJAN PRODUCTS specialises in making light pens for a range of computers, one being the 48K Spectrum. The pen is supplied with driving software on tape which allows you to draw pictures or to choose from a menu.

Once the software has loaded, the pen plugs into the EAR socket of the Spectrum. It takes its power from a PP3 battery which is also supplied. On-screen you are given the option of drawing or instructions. The instructions show you how to use the pen and also how to modify it if you want to use it in your programs as a menu chooser.

All that needs is about 20 lines of Basic and 200 bytes of machine code, both of which are given. When using it that way the code gives a number which corresponds to the line number to which the pen is pointing. In that way it is easy to choose from a list of options.



The drawing program has two movable points and by using them you can draw lines, circles and boxes, fill areas with colour or even draw free-hand. It takes time to grow accustomed to the last option. It is very good with horizontal lines but not so good at vertical ones — they tend to 'wiggle' slightly. Other options allow you to load and save pictures, change colours, insert characters or copy the screen to a Sinclair printer.

The pen worked well and was easy to use — overall a well-thought-out product. The only difficulty which might arise is that due to changes in the Spectrum, older versions of the pen might not work with the latest version of Issue 3s. Trojan will exchange software if you experience difficulties.

The pen is reasonably priced at £17.25 inc. VAT and p&p and is available direct from Trojan Products, 166 Derlwyn, Dunvant, Swansea SA2 7PF or local computer shops.

Rainbow interface

A NEW joystick interface has been released by Rainbow Electronics. It has a built-in beep amplifier. The interface has one good point in that it can be programmed as a game is running. Other than that not much can be said for it.

To program it, you have to hold down a key, move the joystick, and then release the key. You must do that for each of the normal four positions, then again for the four positions while also holding the fire button and again if you want to move diagonally, a feat which would need at least three hands.

Once programmed, a switch on the front of the interface is moved to the play position; it disables the keyboard. Finally there is no volume control for the sound amplifier.

The interface is also poorly made. The 28-way edge connector normally has a plastic locating blank to line it up. In this case it is merely a blob of solder. The connector, and the joystick socket, are stood off from the interface PCB by about 1in.

The unused pins are left hanging. That is very unstable and could short out. There are also some resistors soldered in mid-air rather than via the PCB.

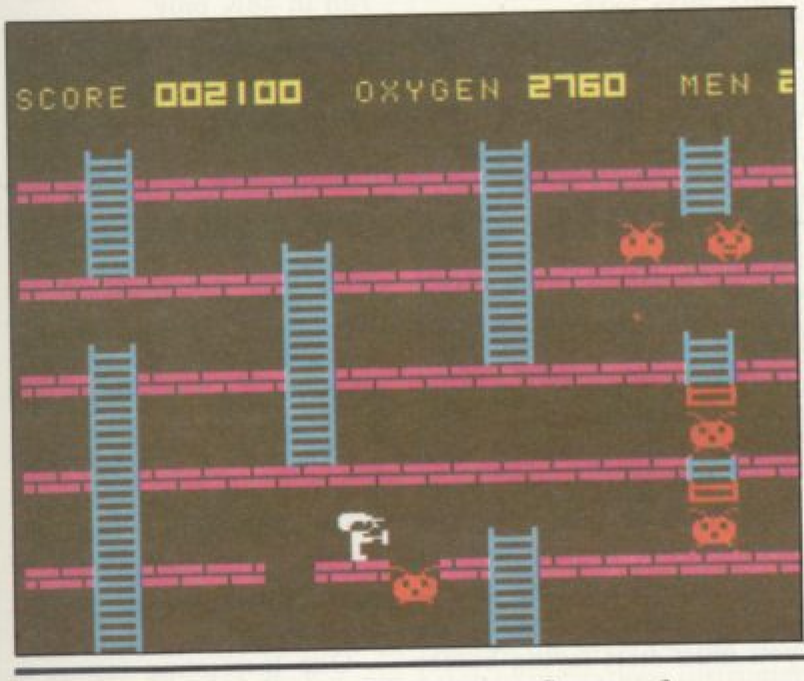
At £24 plus £1 p&p the interface is competitively priced but could not be recommended. Rainbow Electronics is at Glebe House, South Leigh, Witney, Oxfordshire OX8 6XJ.

Sam Spade strikes the manic mines

THE MINER or explorer being chased through subterranean caverns by monsters of many kinds is now a common motif in computer entertainment and it would take a vastly superior program to oust Manic Miner from its place at the top of the pile. **Sam Spade** from Silversoft, which will run on any Spectrum, is yet another version on the theme and is no real contender against Miner Willy. Sam, our hero, is a miner digging kryptonite in the usual multi-layered cave. The precious ore is guarded by small, fast-moving monsters of red, green and yellow varieties. Sam is moved up and down the cavern using the keyboard or a Kempston joystick and climbs ladders to move from one level to the next.

To survive and to score he must dig holes with his hammer through which the monsters will fall, provided they are helped by a few taps on the head as well. Red monsters will die by falling only one level but to kill the others the player must dig sets of holes, as the green and yellow baddies must drop two and three levels respectively to be destroyed.

That takes some doing — the monsters are fast and voracious and it is all too easy to paint Sam into a corner. There is the added difficulty of a decreasing air supply.



While the program ran smoothly, the format became rather repetitive after a time, even though one's ingenuity is taxed by putting the proper holes in the correct places. The game is no match for the ever-moving, ever-changing caverns through which Willy has to struggle and leaves Sam as an average kind of miner, undistinguished by comparison.

SAM SPADE
Memory: **Any Spectrum**
Price: **£5.95**
Joystick: **Kempston**
Gilbert Factor: **5**

Arcturan mind match

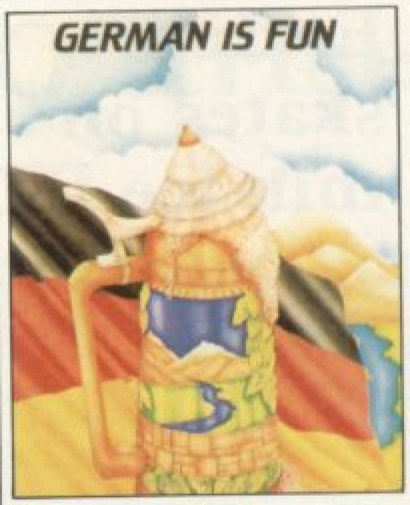
MIND GAME enthusiasts should find **Arcturus** from Visions Software Factory just the thing to occupy a few spare hours — or days. At the start of the tape are about 20 screens recounting the saga of how the Arcturans' ultimate mental challenge formed part of a plot to take over the free world and, although there seems to be no harm in it, it is not clear why it was included, since it has no bearing on the game. So, unless you have nothing better to do, skip the saga and start with the demonstration of the game, which could be described as a complex form of noughts and crosses.

Each player attempts to place noughts or crosses in a line of four on either one single squared board or across the four which are shown in perspective, superimposed one above the other on the screen. What constitutes a line, difficult to grasp at first, becomes clear after a few bouts against the computer, which can operate on 10 levels of skill.

Apart from that, the game incorporates a number of other choices and refinements. You can play against another player instead of the computer, with or without sound effects, and with the clock switched on or off. You can also replay a game, load and save one, or consult the computer for help.

The screen display is clear and the method of making moves is simple and convenient; you use the cursor keys to move round the squares and press ENTER for the square you want. For those who like to pit their wits against a computer rather than human opponents, it is a well-presented version of an unusual and interesting game.

ARCTURUS
Memory: **48K**
Price: **£6.95**
Gilbert Factor: **7**



Gentle German

USING a combination of graphic displays and word drills, **German Is Fun** presents German vocabulary and phrases for beginners in a way reminiscent of a standard idiomatic phrase book. The program is divided into nine main topic sections which deal with the areas most likely to be of use to the holiday-maker or basic student.

The main menu provides a simple selection procedure for each topic. When a selection is made a set of options is offered which will allow the student to choose the picture only, the picture with test, phrases only or picture with phrases. The first option sets up a picture, item by item, showing the corresponding English and German words, while the second will test you on those words.

The program is very user-friendly, allowing exit from any section at will and, in the word-test section, providing the next letter in response to a question mark. The graphics are cheerful and well-drawn with some movement at certain points. It is a meticulously-devised program and, for anyone who has a basic grasp of German pronunciation will be extremely useful as a supplement to oral experience.

GERMAN IS FUN
Memory: **48K**
Price: **£5.95**
Gilbert Factor: **8**

Eskimo skates on thin ice

ESKIMO EDDIE from Ocean Software invites the player into the Arctic. Eddie must battle against Growler the polar bear in his attempts to rescue Percy the penguin. On the second screen the penguin must defend itself against deadly snowbugs by pushing ice-blocks into their paths.

That is rather a dramatic description of the action on-screen which gives the impression of a frosty Frogger. In the first part the player must steer Eddie up the screen by keys or a variety of joysticks. Two polar bear figures and three jagged icefloes march across and Eddie will be killed if he makes contact with them.

After a few tries the graphics display is not very gripping or colourful. The repetitive quality of the tasks will not appeal to those fond of complex games, though it is possible younger children will enjoy it for a time. All in all, a disappointing production from Ocean Software.

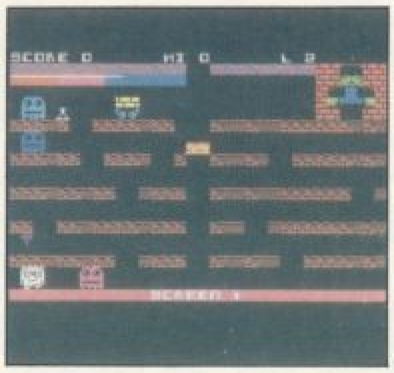
ESKIMO EDDIE
Memory: **48K**
Price: **£5.90**
Joysticks: **Kempston, Sinclair, Protek**
Gilbert Factor: **4**

Dr Franky falls foul of the ghastly ghosts

IT IS FORTUNATE the reviewer of **Dr Franky and the Monster** already had his own copy of the program. The game provided for review loaded perfectly, displaying the initial Manic Miner-style cavern, a few ghosts, the flask of elixir and the famous monster waiting for life to be poured into him. There it stopped, as the motion keys failed almost completely to obtain response on-screen. Irritation replaced interest after a dozen or so attempts to play.

There appeared to be no data corruption, however, and the second copy functioned perfectly. Whether it was one bad tape or a potential bug is yet to be seen so, if you buy the game and have similar problems, refer it to Virgin Games.

The aim is to bring the bolt-necked monster to life by collecting a flask of chemicals which must then be given to the lifeless hulk at the top of the tiered caverns, nine in all. The gloomy dungeons are also populated by the ghosts of the wretches whose spare parts have been used to manufacture the monster. They will hunt you as you attempt to move and jump along the



passageways. There are other hazards such as mine wagons and bridges to negotiate. Movement is simple using only three keys.

The graphics are bright, fast and clear and you will need to move with some speed to avoid the vengeful ghosts. The monster comes to life with a satisfying electrical glow once the flask has been taken to him by the bizarre Dr Franky and good timing and judgment are needed to do that successfully. Dr Franky is an enjoyable and attractive game but, in view of the problems experienced by the reviewer, it may be wise to check that your copy runs well before you leave the shop. Dr Franky and the Monster will run in 48K only.

DR FRANKY
Memory: **48K**
Price: **£5.95**
Gilbert Factor: **6**

Robots are revolting

ROBOT RIOT from Silversoft centres on a revolt of the robots in which the only way to regain control of the building is to lay bombs over the entire floor area and thus force the King robot to escape from his central control room. That is not the end, however, as it will escape only to another floor, where you must start laying bombs again.

Anyone who has played Pac-man or any of its many derivatives will be familiar with this game, where the main difference from the original is that instead of eating dots you are laying a trail of them.

You lose a life whenever you run out of power but in yet another familiar touch the regular consumption of power mites will prevent the disaster.

One interesting feature is the way the game starts with an introduction to the various robots, with details of their speed, intelligence and destructive powers. Apart from that, **Robot Riot** can in no way claim originality but it manages to be absorbing and addictive, especially if you enjoy maze scenarios, and the robot graphics are lively.

Experienced players may find it slow and it is a pity that each time you lose a life you have to return to the start, instead of continuing from where you left off, making the game more frustrating than it need be.

ROBOT RIOT
Memory: **48K**
Price: **£5.95**
Joystick: **Kempston**
Gilbert Factor: **6**

Nuclear reactor risk increases

READING the playing instructions to **Reactor** from Gemini might lead you to believe that you have to be a nuclear physicist to play, but in practice the game is not so complicated as it sounds.

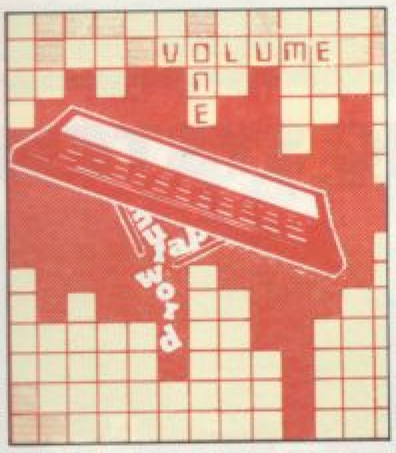
The object is to control a nuclear reactor by moving a control unit in such a way that the metal elements bounce from it at right angles and hit the central discharge unit, a tricky manoeuvre until you get used to it. Each time you accomplish it successfully, the power of the reactor increases and radiation is kept under control.

There are neutrons to take into account; whenever they hit a piece of metal it splits into two, increasing radiation. Further, if you collide with metal after having absorbed neutrons, you lose one of your four lives.

Keeping power up and radiation down for the required time leads to the next stage of the exercise, which involves laying a trail of concrete to box-in every metal element in sight. You can then go on to try your hand at controlling a new and more difficult reactor, knowing that sooner or later nuclear power will inevitably get the better of you.

The graphics are relatively simple but the game offers a new and original concept and its degree of difficulty is well-judged to keep you playing for a long time.

REACTOR
Memory: **48K**
Price: **£7.95**
Joystick: **Kempston**
Gilbert Factor: **7**



Cross words

WORK FORCE appears to be attempting the impossible with its **Computaword,** with predictable results. It is difficult to think of any advantages a computerised crossword might have over the simple but much-loved printed variety and Computaword fails to demonstrate any. Not only would you have difficulty in taking it on the train but it presents all kinds of other obstacles, such as the time it takes for the grid to display, the difficulty of consulting clues, and the laboriousness of entering answers. All of those difficulties could be abolished by using paper and pen.

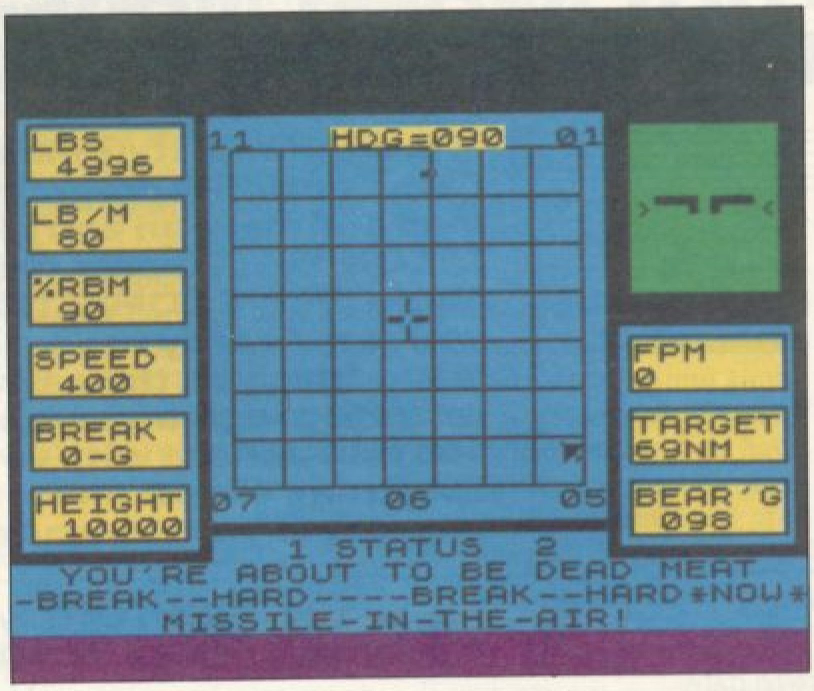
The program might have offered a crossword which was more intelligent than an ordinary one but that is not the case. Computaword accepts incorrect answers; if you ask it for help it fills-in the whole crossword rather than answering one clue; and, to top it all, it even plays *Congratulations* after it has supplied the correct solution for you.

There are 10 puzzles which adds to the variety but also to the total amount of loading time needed before you can play. The crosswords are straightforward but difficult to solve, so that the program would not even be suitable for introducing newcomers to crosswords.

COMPUTAWORD
Memory: **48K**
Price: **£6.95**
Gilbert Factor: **2**

Phantom NATO strike on the Spectrum

THE CASSETTE cover of **Strike Attack** from Micromart for the 48K Spectrum claims that the program is the ultimate simulation, which might lead a potential buyer into thinking that the program has similarities to the Psion or Hewson programs which feature visual representations of cockpit views. The instructions enclosed are more explicit and tell you that you will be provided with all the information you would have obtained by instrumentation or by visual means.



In fact, the player is cast in the role of the navigator of a NATO Phantom attempting to destroy an enemy base with bombs and is provided with a set of readings indicating flight status. The situation outside the aircraft is represented solely by a grid in centre screen on which graphic symbols depict target, hostile fighters and the Phantom.

Using the keyboard, the player moves the aircraft across the grid, paying attention to the various instrument readings and hoping to avoid missiles and other attacking aircraft by breaking. That is meant to represent the tight turns necessary in air warfare to escape attack. Warnings are flashed on-screen to describe the type of attack. There is a training mode and an operational level.

The instruction manual is rather impenetrable but after a few practice runs you will appreciate the general idea if you are not deterred by witty comments like "You jerk, you didn't break hard enough'. The program seems to run very slowly and the response time to commands is slow. That becomes a real disincentive to continuing after a time and there is little feel of controlling an aircraft — more the sense that you are obeying the computer orders.

Because of that the game is not compelling enough to make you want to get back in the air. Two or three attempts after the training sequence convinced the reviewer to seek pastures new. The program did not live up to the packaging.

STRIKE ATTACK
Memory: **48K**
Price: **£6.95**
Gilbert Factor: **4**

Pi-man's gold gamble

ANYONE concerned about the fate of the Pi-man will be relieved to hear that after the alcoholic excesses of Pi-eyed, he is now utterly reformed, even to the extent of entering for five events in the Olympic Games.

That, however, is probably the best piece of news about the latest game from Automate, **Olympimania.** Apart from the usual excellent graphics — the most spectacular sequence is the Olympic stadium with its rostrum and wildly waving crowds — the game has a limited amount to offer in the way of entertainment. The five events — Pi-jump, Alpi skiing, Pitathlon and so on — are all similar, with a series of obstacles to jump and some unlikely hazards to overcome, such as rival competitors who dig holes beneath the Pi-man, or fish and alligators in the case of the swimming event.

In all the events, it is extremely difficult to win a bronze medal, let alone a gold, and as a result the interest soon palls in spite of the amusing graphics. The reverse side of the tape, true to Automata traditions, has a pop music track, described as a choral extravaganza of the Piland International Anthem. The kindest thing to be said about it is that by comparison it places its companion game in a favourable light.

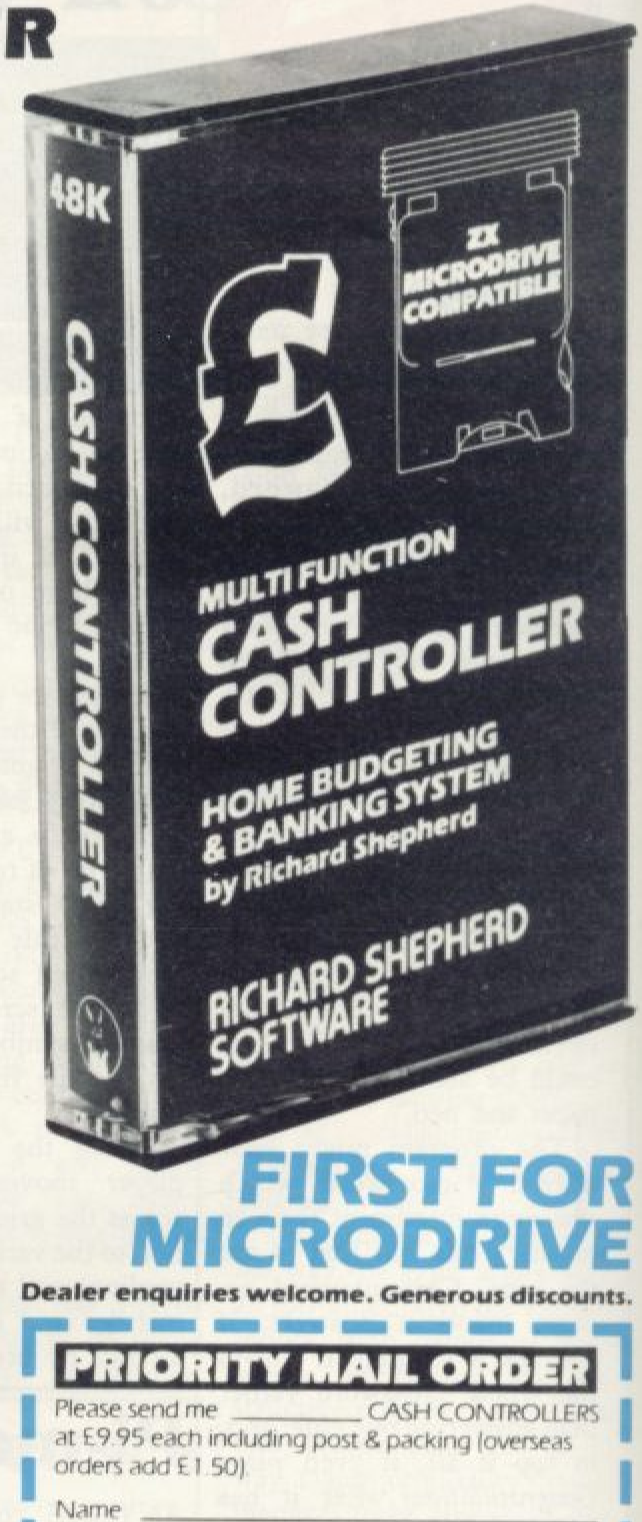
OLYMPIMANIA
Memory: **48K**
Price: **£6**
Gilbert Factor: **6**

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Favourites of yesteryear

THE ZX-81 may leave much to be desired as an arcade games machine but it is perfect if you want to play adventures. A good keyboard is not necessary and high-resolution colour graphics is not an integral part of adventures which are, in most cases, text only. The ZX-81 also has 16K of usable memory, so a programmer is not restricted by RAM requirements.

It is not surprising therefore that many good adventures have been developed for the machine. One of the first to be produced was **Ship of Doom** from Artic Computing. It has a text-only format and follows the usual space plot where your player-char-



acter is stranded on a strange and alien ship which you have gone to investigate. You have to suffer the perils of ice and metal rooms while trying to find the key to the control room of the spaceship.

As one of the first adventures it was accepted with glee by the addicts. Few people have managed to solve it, although it is one of the easiest adventures in the Artic series.

Ship of Doom can be obtained from Artic Computing.

The area of graphics adventures has not been left unexplored by eager programmers. Carnell Software was the first to exploit that field with **Volcanic Dungeon.** The major part of that adventure consisted of text but the player is given a map of the caverns in which play takes place. The map is not very helpful and it is all too easy to be burned to a crisp, frozen, or blasted by the evil witch Magra and her denizens.

Play in the dungeon is undemanding, as nearly every turn is taken up with fighting monsters. The monster conflicts are so random that one of every three or four is likely to end your life and leave you waiting for the game to be initialised again. The game is slow in execution — most of it is written in Basic — and death is always too swift. It is as if the computer is playing the player and not the other way around. Our experience shows that Magra gets the better of an adventurer. The Volcanic Dungeon is available from Carnell Software.

Pimania is another graphics adventure from Automata. The graphics are short intervals between moving or solving problems but they contain some important clues as to how to solve the central problem and find the Golden Sundial of PI.

The Pi-man is an irritating little character who appears at seemingly random moments during the adventure or when you ask for help. In return for some favour, he will give you a clue as either a riddle or a jig which he dances in classic cartoon style.

You might feel as if you could do without the Pi-man but he is necessary for the completion of the adventure, so you should keep on the right side of him.

Pimania is a clever and classic graphic adventure. Whether you want to buy it is another matter. You might be drawn by the prize in the competition but is a game which could take more than two years to solve worth playing?

The Trader Trilogy, from Quicksilva, could be loosely termed a graphics adventure. In the set of three games you are in charge of a spaceship which roams the galaxy in search of adventure. You are a trader and in your planet-hopping experiences you meet many types of alien creature. The monsters include a fluff-ball which survives on your brainwaves, a whole population 'high' on a drug with effects like Mescalin, and robots giving way to rust.

On the first run of the adventure, which has to be played in a sequential format, the graphics and plot are entertaining and you will keep playing until you are killed or find sufficient supplies to make a profit. On the second and succeeding runs you will become less pleased with the game.

The Trader Trilogy may be of some interest to children but even they, if they are discriminating, will grow tired of always answering the same mathematical problems to find cargo. The trilogy is the least promising of Quicksilva games for any machine and deserves to be zapped into space.

Continuing the coverage of strategy games, **Football Manager** from Addictive Games puts you into the seat of a team manager looking for



division in which it starts to the first division and make sure that you are not relegated.

success or, on the other hand, failure, on the pitch and bankruptcy.

There are seven skill levels, although we found the first three difficult enough. You have to make sure that your team moves from the

Dallas is another strategy game but more down-to-earth than the others in the round-up. As you might expect, it contains all the elements necessary to turn you into an oil baron who wants to take over the Ewing empire. You have to prospect for the best land and build a pipeline and production plant on it.

All kinds of problems will crop up including tornados, heavy rain and earthquakes. If you are not quick enough you will find the Ewings have taken over your little empire.

Dallas is an excellent strategy-simulation which improves the more you play it. The game is addictive, which is a comment which could not be applied to many games of its type. If you fancy a trip into the world of the Ewings, Dallas can be obtained from Cases Computer Simulations.

SHIP OF DOOM
Memory: **16K**
Price: **£6.95**
Gilbert Factor: **7**

VOLCANIC DUNGEON
Memory: **16K**
Price: **£5**
Gilbert Factor: **5**

PIMANIA
Memory: **16K**
Price: **£10**
Gilbert Factor: **6**

TRADER TRILOGY
Memory: **16K**
Price: **£6.95**
Gilbert Factor: **6**

FOOTBALL MANAGER
Memory: **16K**
Price: **£5.95**
Gilbert Factor: **7**

DALLAS
Memory: **16K**
Price: **£5**
Gilbert Factor: **6**

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This amazing program contains 15K of pure machine-code to teach you to **WRITE YOUR OWN GRAPHIC ADVENTURES!** It was two and a half years in the making, but now you can easily learn to write - and illustrate - machine-code adventures. 100-page manual helps. NO STIX. **48K Dream £9.95**

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FIGHTER PILOT

"A superb simulation ... as a piece of programming it's impressive, as a game it's not to be missed." (CompChoice). *"THE FLYING IS THE BEST I'VE COME ACROSS."* (PCGames). 3D cockpit view, 3D air-to-air combat, stunning instrumentation. 7 Options include landing practice, flight training, combat practice, actual combat. 4 skill levels. KEMPSTON, INTERFACE 2, AGF STIX. **48K Digital £7.95**

DENIS

"Rapid-response, superbly complex game ... great fun to play ... excellent." (PopCompWkly). Funny, friendly text adventure. As Denis Thatcher you travel up to 95 locations, seeking peace in the pub. You must find a drink every few moves, while dropping in on the Royals, the MPs and maybe the Pope (wearing a truss and carrying a lawnmower). Written with THE QUILL (£14.95). NO STIX **48K Applications £5.50**

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In addition to the first prize there are four second prizes of £250 each plus royalties and 25 runners-up prizes of five CCS programs. All prize-winners will receive a free annual subscription to *Sinclair User*.

We are looking for exciting programs which present the player with a challenge in decision-making and tactical play. Games which graphically depict real-life situations, such as piloting an aircraft or driving a motor vehicle, will also be considered, as will games which have a particular appeal for girls. The categories of programs which, therefore, can be submitted include adventure, strategy, simulation and war games.

Entries will be judged for originality and innovation, playability and addictive quality, graphics and the use which is made of the computer. The presentation of the instructions and the program documentation will also be taken into account.

The award will be judged by the same panel of experts who judged the 1983 Cambridge Awards — Mike Johnston, consultant editor of *Sinclair User* and organiser of the highly-successful and long-running ZX Microfairs; Trevor Toms, author of many best-selling Sinclair computer books; and John Gilbert, deputy editor of *Sinclair User*. A representative of Websters Software Ltd will also be on the panel, which will be chaired by Bill Scolding, editor of *Sinclair User*, and Melvin Lloyd-Jones, a director of CCS.

The presentations of the awards will take place on October 4, 1984 at the Ritz Hotel, Piccadilly, London W1.

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Description of game ....

....

....

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- Entries must reach *Sinclair User* at 196-200 Balls Pond Road, London N1 4AQ not later than Wednesday, August 4.
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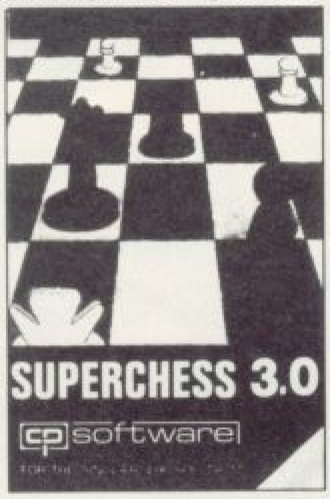
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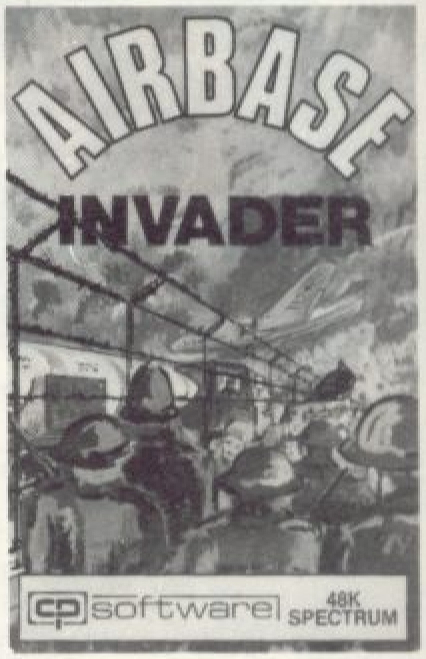
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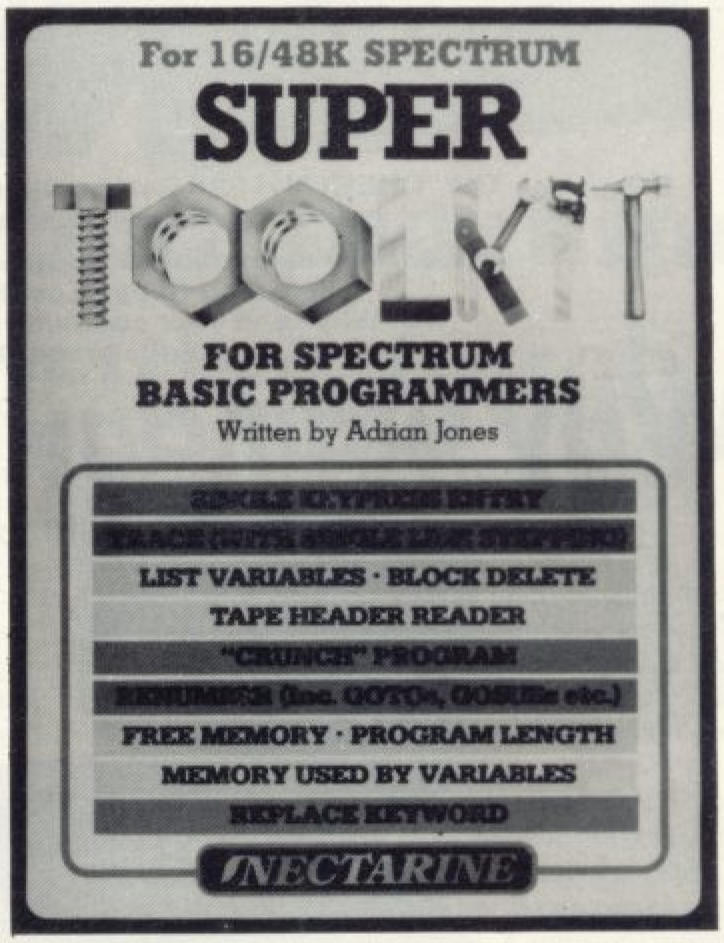
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Give your machine the positive touch

John Lambert flexes his fingers over five professional keyboards for the Spectrum

ONE OF the first add-ons for most Spectrum users is a full-size keyboard. While the original keyboard was a vast improvement on the ZX-81, it is still very limiting if you use your Spectrum a great deal. For professional use it is almost a necessity.

In the last few months six new keyboards have either been announced or appeared on the market. Of those, we managed to obtain four for review, one was seen in its prototype stage and we are still waiting for the other.

In each case we fitted a Spectrum and Interface One to the keyboards to see how difficult it was and also tried to fit a power supply inside, where there was either room or it was suggested in the instructions. We also tried to connect a Kempston printer interface, which is a fairly standard interface and did not fit on some of the older keyboards. Whether or not it fits can therefore be taken as a measure of how other add-ons will fit.

The feel and size of a keyboard are important; after all, they are the reasons for buying a new one. The sizes are given in the table but the feel is more difficult to measure, as it will differ from person to person. If possible, visit either a local computer shop or one of the Microfairs and try them yourself; if you cannot do that any of the keyboards should be satisfactory.

The Maplin keyboard, marketed under the name Mapsoft, is for the home hobbyist, in that it is supplied in kit form. It is also the only one which connects to the user port of the Spectrum. There is an extender PCB which fits on to the Spectrum and a ribbon cable to the keyboard.

> 'The Fuller FDS probably started the sudden interest'

It has 47 keys, the normal 40 plus Delete, Graphs Lock, Shift Lock, Caps Lock, single key E Mode and two space keys. There is also one extra key which you can wire up to your own requirements.

Making up the kit is straightforward, provided that you are used to soldering; if not, it might be an idea to practise first. None of the chips is socketed and special care has to be taken with them.

The made-up board is fitted into a thin plastic moulded case, the top of which is held in place by pieces of Velcro and has the colour legends for keys 1 to 7 and 0. The legends on the keys are three colour cards which fit under a clear plastic top.

Unfortunately the keyboard was received late for review and we did not have time to test it fully. First impressions, however, were favourable, although the case appears to be fairly flexible. If you prefer making your own keyboard, this is perhaps the best, if not the only one available. The kit costs £44.95 inc. and can be obtained from Maplin Electronic Supplies, PO Box 3, Rayleigh, Essex SS6 8LR, or from its many shops.

The dK'Tronics model for the Spectrum is largely the same as the old, with the same stick-on legends. The case is made of plastic and there are extra holes in the back to allow connection to Interface One when fitted.

To fit the Spectrum in the keyboard it must be taken out of its case and screwed to the new base. If you have an Interface One, that is fitted first and the Spectrum PCB is slotted into it and then screwed down. As the PCB is fitted in the back right-hand corner, there is an extender PCB for the Microdrive lead which connects to Interface One by the solid connector supplied with the Microdrive. The lead is taken out of the case through a small slot in the left-hand side.

Also on the left-hand side are three pillars on which you can mount the power supply. To do that the power supply must be taken out of its case and should therefore be fitted only by people who have some electrical knowledge. There are a number of problems fitting this power supply — the Sinclair power supply has gone through a number of design changes. If it is marked Made in U.K. on the base it will probably fit on the pillars.

When fitting Interface One it may make the back of the case bulge slightly. It is possible, however, to trim the case but that should not be necessary and is poor design. The Kempston interface will not fit unless you are using Interface One; again, it is possible to trim the case.

Despite those difficulties and the lack of a full-size space bar, the keyboard has been very popular in the past. The reviewer has used the old version for the last nine months and it has proved reliable. It is a pity that dK'Tronics did not put a little more thought into the new version, as it could have made a good keyboard even better. Overall, however, it is a good keyboard; it has a pleasant feel to it and can be recommended. It is available, price £45 plus £1.25 p&p, from dK'Tronics, Unit 6, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ. Tel: 0799 26350, or through the Spectrum chain of shops.

The keyboard which probably started the sudden interest is the Fuller FDS. It has been a long time arriving and has had more written about it than any other keyboard — not all of it good.

As well as the usual 40 keys, it has an extra 11, including a full-size space bar. The extra keys are four direction keys —

continued on page 47

continued from page 45

they are shifted 5, 6, 7 and 8, very useful when editing or using a word processor; two function keys which put the Spectrum into extended mode — f1 gives the red functions and f2 the green; extra Caps Shift and Symbol Shift; and single-key entry for Delete, Comma and Full Stop. All the keys have their legends printed on them, the main functions in white on the top and Extended mode functions on the front in red.

Fitting the Spectrum inside proved somewhat difficult, as the screw positions did not line up exactly with those on the Spectrum PCB; with a little effort it can be made to fit if one of the screws is omitted. When trying to fit Interface One more problems arose. In this case the Spectrum is fitted at the front and Interface One at the back, with a flexible connector between them.

Fuller does not supply that as standard. As the Spectrum is so far forward

'Saga could have a winner with the new Emperor keyboard'

the power, cassette and aerial sockets are inaccessable when the keyboard is put back together and would therefore either have to be fitted permanently or additional leads made up and brought out to the back, where holes would have to be drilled in the case to take them. Neither is there a slot for the Microdrive lead and that would have to be cut out if required.

The Spectrum power supply is connected directly to the keyboard; a lead which goes to the Spectrum is only just long enough — if you have the Fuller Master Unit you may have to extend it. That also means that if you want to move your Spectrum, you have either to open the case to unplug it or take the power supply with you. It should be possible to fit it inside the case and Fuller has put four pillars in the back right corner for it. Unfortunately they do not line up with any of the holes on the power supply PCB on either version and would need a great deal of ingenuity to fit.

In use, the keyboard was reasonably good, the extra keys being a boon when using a word processor, particularly the arrow keys. Unfortunately it was impossible to get shifted Z, X, C and V. That would appear to be a design fault, as we had two keyboards for review and the fault was common to both. Other



than that, the keys were a little stiff but that is only to be expected with a new keyboard.

All-in-all, the keyboard could have been very good but it has too many little faults and a few major ones. If you can obtain one where the keys work correctly and are prepared to spend a little time customising, it would be worthwhile buying, otherwise do not bother. It is available, mail order only, costing £49.95 plus £2.50 p&p, from Fuller Micro System, 71 Dale Street, Liverpool 2. Tel: 051-236 6109. The emergency enquiry number is 051-709 9280.

The new Saga keyboard, the Emperor, is still in the prototype stage but was expected to be readily available by the latter part of April. We were able to have an exclusive preview of the new model which looks as if it will provide the first real competition to dK'Tronics.

There are 67 keys, the normal 40 in white, plus 27 beige function ones, including full-size space bar. They are four shifted arrow keys, 5, 6, 7 and 8; two unshifted ones, 6 and 7, plus 0, to be used in games; two extra Caps Shift and Symbol Shift; and single-key entry for Edit, Delete, Caps Lock and Graphics. In addition a number of keys which normally need symbol shift are now single-key entry; for mathematicians, plus, minus, divide, times and equals; for word processors, comma, full stop, colon, semi-colon and quote; and for programmers, greater than, less than, string and hash.

Fitting is very straightforward. Only the top of the Spectrum case is removed and the base, containing the PCB, is bolted to the bottom of the keyboard. In that way Interface One will not have to be taken out of its case and will fit directly to a Spectrum base. The Kempston interface will also fit if the strain relief bar is removed. On the top of the keyboard is a groove to hold pens.

Saga could well have a winner if the production model is anywhere near as good as the prototype. It will cost £54.45 plus £1.15 p&p and is obtainable, by mail order, from Saga Systems Ltd, Woodham Road Woking, Surrey GU21 4DL or in person at The Woking Computer Centre, 32 Chertsey Road, Woking, Surrey. Tel: 048-62 23845.

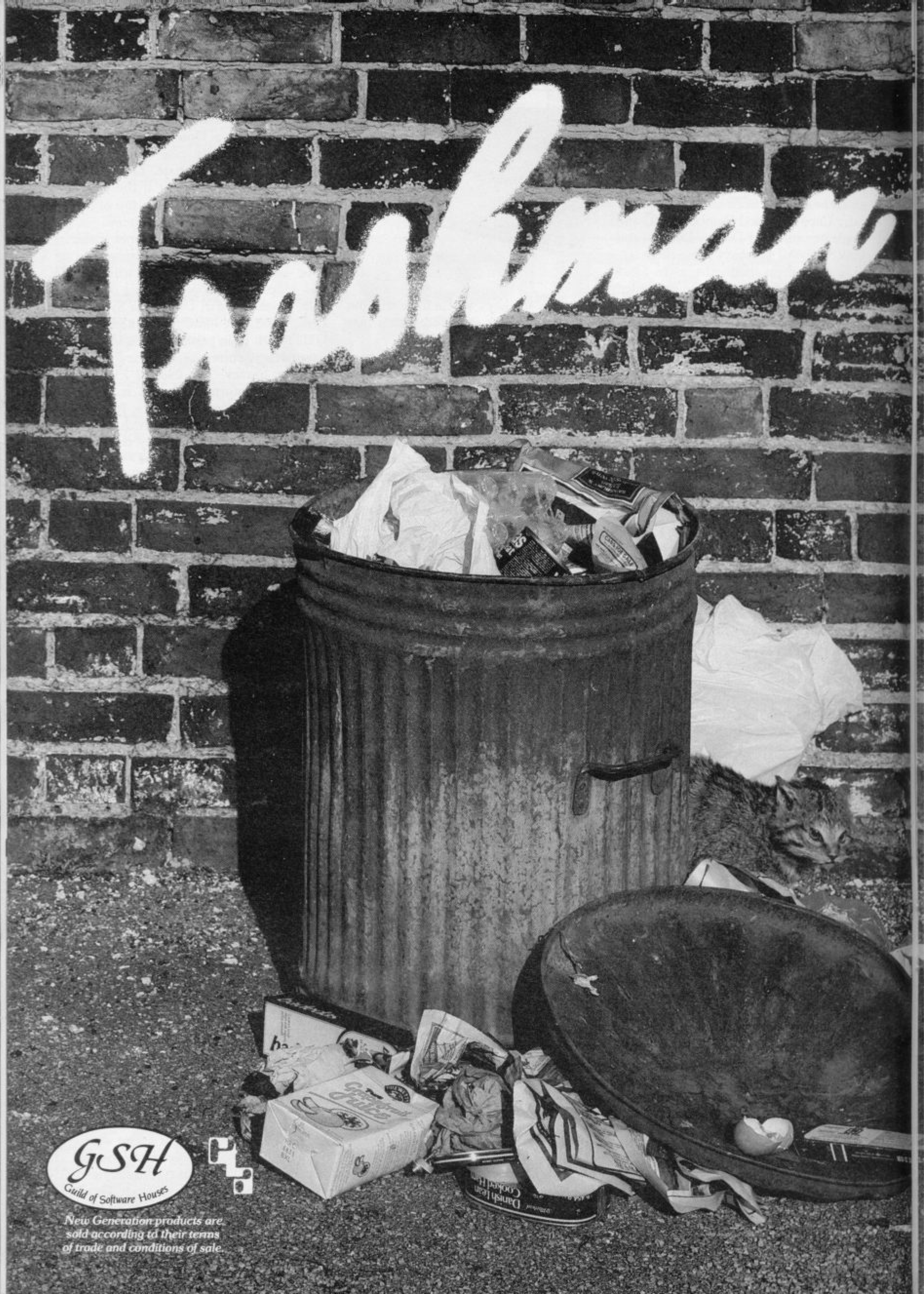
The Transform keyboard is aimed squarely at professional users. It is the only keyboard reviewed which had a metal case and also the only one with three-colour printed key caps.

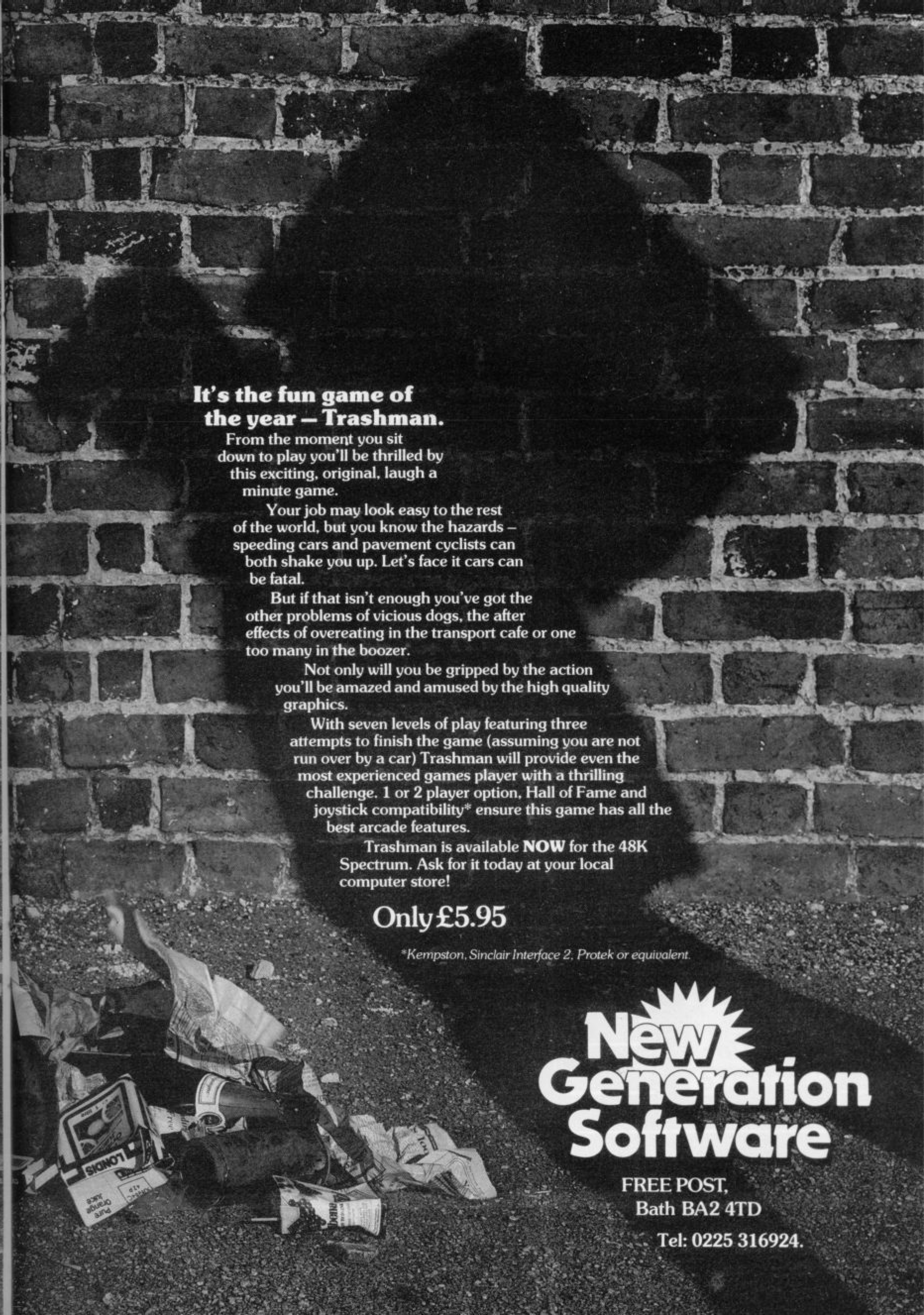
There are 60 keys, including a numeric pad which has an extra Caps Shift and full stop, plus a full-size space bar. The other extra keys are Symbol Shift, Edit, Delete, E Mode, Colon, Semi Colon, Comma and another Full Stop.

Fitting is very straightforward. The base of the Spectrum is retained as an insulator and bolted through to the base of the keyboard. If Interface One is being used, the two long mounting screws have to be removed and the bolts then go through it and the Spectrum. There is provision to put the power supply inside the case and special connectors are used to wire up an on/off switch and a LED. That is also relatively easy. You need not worry about the leads shorting out as everything is well insulated; in any event the switch is on the 9V side and could not cause damage. The keyboard has a solid feel to it and is certainly the best-looking of the keyboards reviewed. The only problem which may be experienced is that some Issue 3 Spectrums are temperamental when used with it. Its price of £69.95 reflects the kind of use to which it will be put but it is certainly the top keyboard at the moment. Transform is at 41 Keats House, Porchester Mead, Beckenham, Kent. Tel: 01-658 6350.

Make	Length		No. of keys	Price	Size in mm.
	Q-P	Space			
Sinclair	195	N/A	40	Free	230 × 140 × 30
Maplin	185	75	47	£44.95	370 × 165 × 50
dK'Tronics	200	N/A	52	£45.00	350 × 245 × 70
Fuller	185	150	51	£49.95	355 × 255 × 65
Saga	190	150	67	£54.45	370 × 180 × 50
Transform	188	150	60	£69.95	410 × 220 × 75

The length measured across the Q and P keys is the overall distance and is included to give an idea of the pitch.


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Playmates

Can the Spectrum compete in the world of computer chess? Bryan Whitby referees the battle of the micros

ARE THE chess programs available for home computers as good as programs inside the dedicated chess computer? Until now the answer has to be no. In fact, most serious chess players rate home computer programs as being very poor. Now, with the release of the **Cyrus-IS-Chess** program for the Spectrum, the gap has certainly narrowed. The one problem with chess computer tournaments organised between different chess programs is that they are always conducted under tournament regulations, i.e., 40 moves in two-and-a-half hours.

Most people who buy chess programs for their computers, or people who buy the dedicated chess computers, usually like to play against it at a fast rate of response, so all the tournaments which have been organised are of little interest to the average hobby player because of the great length of time the computers are allowed to take under the tournament time regulations.

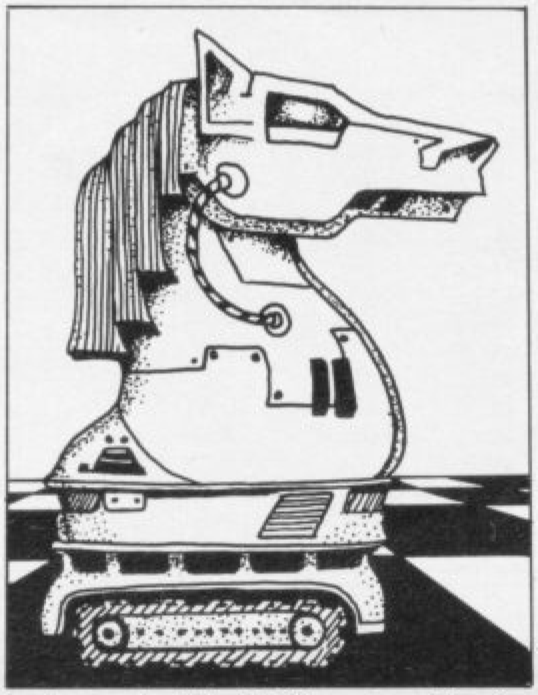
One way to overcome that is to play each program against one another at

> 'The performance of the Sensory 9 was good overall'

every level. That means that if there are six levels of play and you play the computer with both the black and white pieces, you will have 12 games against each computer. That way you will be able to see which chess program will best suit your needs at the response level you will require most regularly.

Being the owner of a Fidelity Sensory 9 chess computer and a 48K Spectrum I decided to obtain Intelligent Software Cyrus-IS-Chess and play one against the other at each level, with both the black and white pieces. Because there was a difference in response time between the computers, certain levels had to be omitted so a total of five levels was used by the Sensory 9 and six by the Cyrus program which gave a total of 12 games in the challenge match.

An interesting feature about the two programs was that in 1981 the Cyrus program had won the European Microcomputer Chess Championship and in the same year the Sensory 9 program



had won the World Championship. So with television, computers and chessmen set, battle began and the contest progressed.

The overall performance of the Sensory 9 was good. In the first half of the match it played steady but not very exciting chess but in the latter half it moved up a gear and duly outplayed its opponent. Game number 10 was the best game Sensory 9 played and was probably the best of the match.

Sensory 9, playing on level 4, and Cyrus, playing on level 6, the game quickly reached the middle game with Cyrus slightly better-positioned but Sensory 9 with Rook and Bishop teaming together started slowly, nibbling away at the Cyrus defence and by the time the end game was reached Sensory 9 had two very strong passed pawns.

It is at such moments that you can learn from chess programs because the way Sensory 9 pushes the pawns nearer the eighth rank, not even strong chess players could have played the ending better. So with both pawns reaching

> 'Cyrus end-game play raised a few eyebrows'

their goal and becoming Queens the Sensory 9 finished the job and picked up another valuable point.

As for the Cyrus program, the same weaknesses showed time and again. After playing the openings usually very well it seemed to lose its way in the middle game, making nonsensical moves which left its pawns hanging. Sensory 9 duly took them and therefore Cyrus usually reached the end game two pawns down and in an inferior position.

continued on page 52

Game	Response	White		Black	Result	Moves
1	5/5 sec	Sensory 9	v	Cyrus	0-1	76
2	5/5 sec	Cyrus	v	Sensory 9	½-½	59
3	15/10 sec	Sensory 9	v	Cyrus	1-0	58
4	10/15 sec	Cyrus	v	Sensory 9	0-1	49
5	15/20 sec	Sensory 9	v	Cyrus	1-0	68
6	20/15 sec	Cyrus	v	Sensory 9	1-0	41
7	30/30 sec	Sensory 9	v	Cyrus	½-½	55
8	30/30 sec	Cyrus	v	Sensory 9	0-1	72
9	1 min/1 min 15 sec	Sensory 9	v	Cyrus	0-1	91
10	1 min 15 sec/1 min	Cyrus	v	Sensory 9	0-1	51
11	3 min/3 min	Sensory 9	v	Cyrus	1-0	63
12	3 min/3 min	Cyrus	v	Sensory 9	0-1	84

Running score

	1	2	3	4	5	6	7	8	9	10	11	12	Total
Sensory 9	0	½	1	1	1	0	½	1	0	1	1	1	8
Cyrus	1	½	0	0	0	1	½	0	1	0	0	0	4

That was a resounding success for the Sensory 9, winning by seven wins to three with two games drawn.

continued from page 51

Cyrus end-game play raised a few eyebrows, especially in game seven, when around move 50 Cyrus had King, Rook and three pawns and Sensory 9 had only King and two pawns. All Cyrus had to do was to take another pawn with its Rook which was there for the taking and move its King up to protect the Rook. Sensory 9 would not have been able to stop the passed pawn on the King's Rook file.

Would Cyrus take the pawn and move the King? In fact, Cyrus would not even take the pawn. It just kept moving its Rook away to a safe square, then back to the square it had just left. So the same moves were repeated three times by each computer and Sensory 9 claimed a draw by repetition — very strange and extremely poor chess by Cyrus.

Another interesting feature of the contest was the number of passed pawns which achieved promotion to Queens. Sensory 9 managed eight and Cyrus three. Almost every game was concluded by passed pawns Queening.

I can only say it was enjoyable to watch the two computers do battle. On more than one occasion the clock crept into the small hours because the excitement was too great just to switch off and adjourn the game.

Sensory 9 won most of the middle games and thus won the match. Cyrus tried very hard and should have won both the drawn games, making the score much closer.

Chess programs for the home computer have not reached the standard of the dedicated chess computer but with the release of the Sinclair QL, who knows, the dawning of the first chess computer grandmaster may be upon us.

Probably the best game from the match is detailed on the left.

•Bryan Whitby is vice-president of the British Postal Chess Federation.

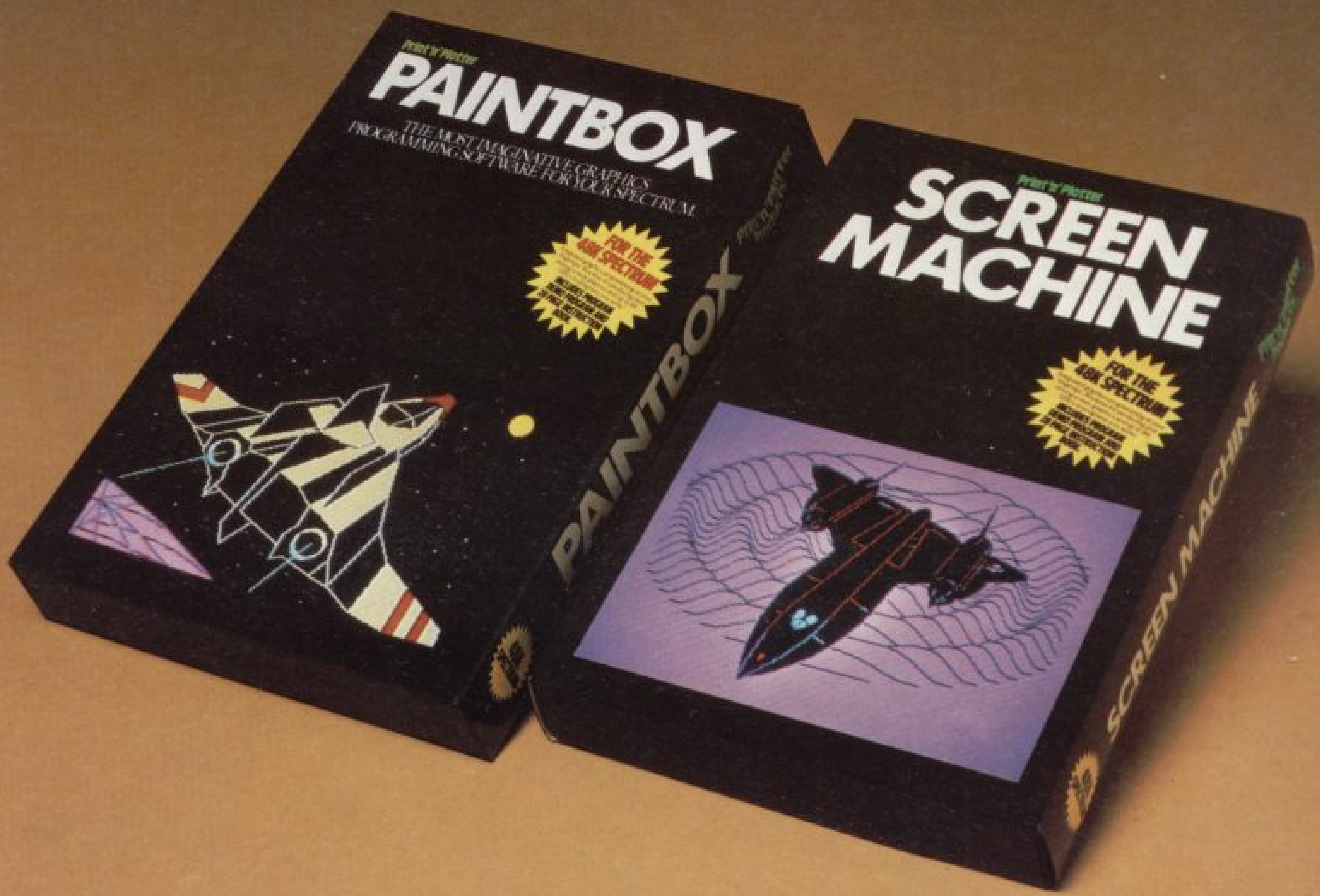
Game 10. Cyrus-IS-Chess v Sensory 9

1.	N-KB3	P-Q4	27.	R-KR2	B-N8
2.	P-QB4	P-Q5	28.	B-K2	RxP
3.	P-K3	N-QB3	29.	R-B2	RxR
4.	PxP	NxP	30.	KxR	P-KB4
5.	NxN	QxN	31.	K-N3	P-K4
6.	N-QB3	B-B4	32.	R-R5	P-KB5 ch
7.	Q-B3	Q-K4 ch	33.	K-N4	R-KB1
8.	Q-K2	QxQ ch	34.	R-R3	P-K5
9.	BxQ	0-0-0	35.	B-B1	P-K6
10.	P-Q4	P-K3	36.	B-B4	B-B7
11.	B-K3	N-KB3	37.	B-K2	K-B2
12.	P-B5	N-K5	38.	R-R7	R-B3
13.	NxN	BxN	39.	B-R6	B-B4 ch
14.	P-B3	B-KB4	40.	K-N5	B-B1
15.	P-KN4	B-N3	41.	B-B4	R-B4 ch
16.	P-KR4	P-KR4	42.	K-N6	RxQBP
17.	PxP	RxP	43.	B-Q3	P-B6
18.	P-KB4	R-R1	44.	P-N4	R-B6
19.	B-KB3	B-K2	45.	B-B5	BxB ch
20.	P-KR5	B-KB4	46.	K-N5	P-K7
21.	R-QB1	B-KB3	47.	KxB	P-B7
22.	R-QB4	P-QB3	48.	RxP ch	KxR
23.	R-QR4	B-B7	49.	K-K4	P-K8 (Q) ch
24.	RxRP	K-N1	50.	K-B5	R-KN6
25.	R-R3	BxQP	51.	K-B4	P-B8 (Q) checkmate
26.	BxB	RxB			0-1



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Chequered career

Chris Bourne talks to high-octane programmer Steve Kelly

ASK MOST PEOPLE about Aintree and they will probably tell you how they almost bet on Lucky Dancer in the Grand National. Ask Steve Kelly of Psion Software and he will tell you the story of his back.

Kelly is from Warrington, where Roy Jenkins lost a famous by-election and Vladivar makes vodka. With his long, hair and drainpipe jeans he looks like the boy next door, the one your parents said would never amount to anything. He left school at 16 and eventually obtained a job lifting heavy boxes. He might still be lifting them had he not injured his back at work.

When he left hospital, manual work was not an option and it was during a Manpower Services Commission rehabilitation course at Aintree that Kelly first had contact with computers — in the form of the ZX-81. He is full of gratitude to the people at Aintree. "It was the best therapy I could have. They were really great people."

After he finished the course, he joined a Government TOPS course in computer programming, learning the training language PL1. It was during the course that he bought his ZX-81 and began programming it.

"I liked playing arcade games like Pac-man but there were no games for the ZX-81. I was learning Z-80 machine code programming from articles in *Sinclair User*. Instead of making the screen go black all over and things like that, I thought why not write a game?"

Kelly managed to sell some of those early games, such as his version of Pacman, to Microgen, but at that stage he was still thinking in terms of using his programming skills in a business career.

"I expected to go into business after the TOPS course but nobody wanted me. I lacked the qualifications. You need A levels and a degree and an IQ of nine million," he says.

David Potter of Psion, on the other hand, was not interested in A levels and the like. Kelly says: "I wasn't trained but I thought I would have a go. I was interviewed on the Tuesday and the next Sunday Potter offered me the job. After two-and-a-half years out of work it was incredible."

Kelly joined Psion in October, 1982 when the company was putting the finishing touches to **Flight Simulation.** The company had been around for some time, linked closely to Sinclair Research, with which it had a deal. Any programs written by Psion for a Sinclair machine are first offered to Sinclair to be marketed under the Sinclair name. So far, Sinclair has not refused any of its products.



Kelly wrote the explosions for Flight Simulation but his big personal success at Psion came with **Chequered Flag,** the Formula One racing simulation.

"Potter had the idea on an aircraft and thought it would make a great game for the Spectrum," he says. He thrashed out the idea with Charles Davies and they went to Kelly. They told him they wanted a car race game with 3D graphics like those in Flight Simulation, with the car controls at the bottom of the screen. Kelly says he would have liked to have had other cars to race against in the game but that would have made it more of an arcade game and less of a realistic simulation. It was obviously impossible for the team to drive Formula One cars round Brands Hatch but they hit on the idea of power curves to simulate engine performance. Programmer Steve Townsend designed the engine and, as speed of operation was the priority, the program used tables of data linking gears, speed and engine revolutions rather than set formulae which the computer would have had to work out every time the controls were altered.

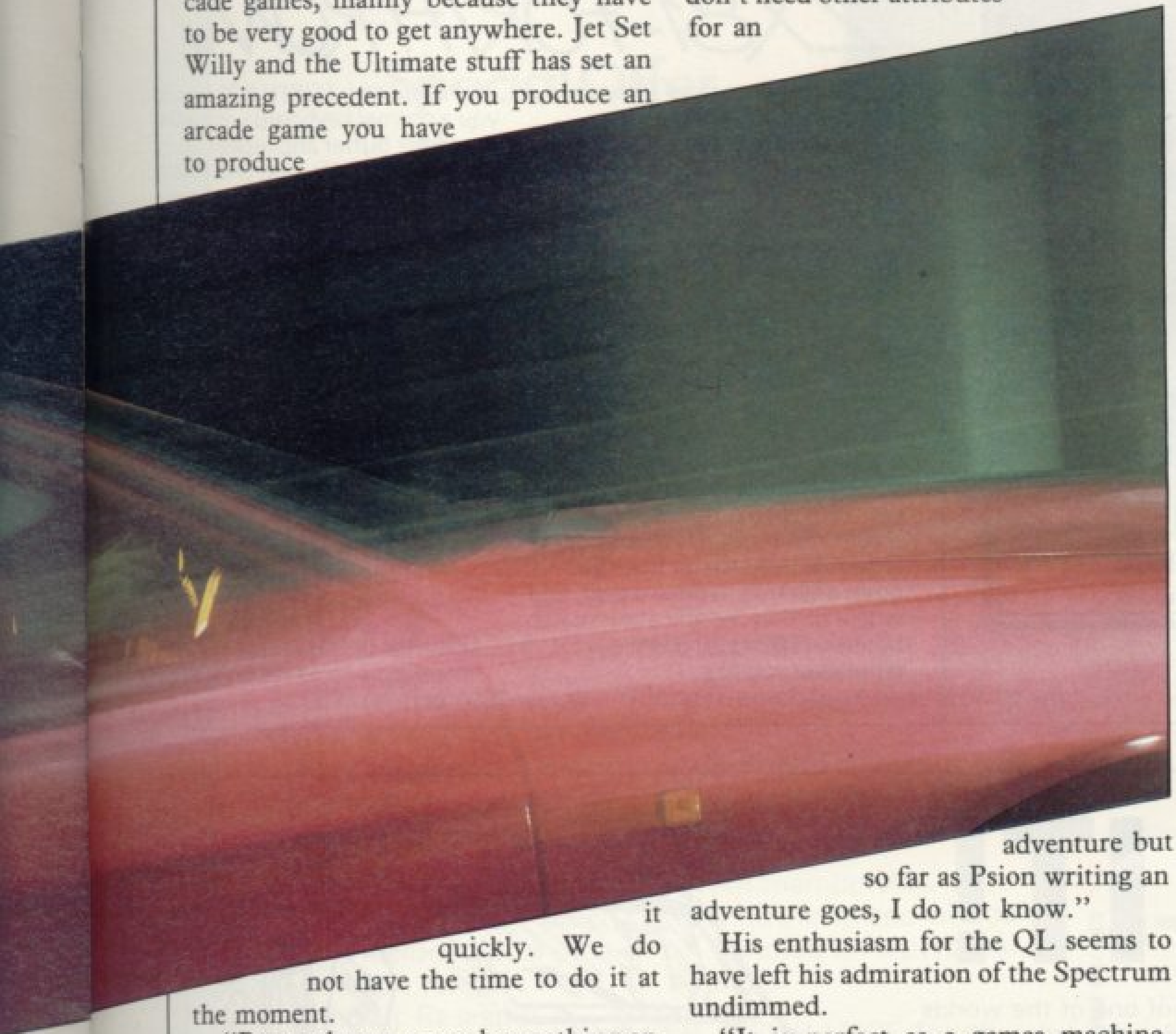
Kelly attributes much of the success of the game to the constant revisions made during programming. They did the road sections three times and were still not satisfied.

Kelly is scathing about companies which produce games without taking such care to have each stage exactly right. "Companies produce games which are not as good as they could be. Some clearly do not change halfway through. I see many games getting a lot of mouth and I am sure we could do better."

Apart from his new-found love of motor racing, Kelly is a keen photographer and regards himself as a connoisseur of bitter and tea. He also likes listening to music. "I like Killing Joke, the Sex Pistols, Tangerine Dream and

the Police." He also misses his roots — "It's good up North. I miss Warrington, I always look forward to going back home." He also likes playing arcade games but apart from a few early games which Sinclair wanted for the launch of the Spectrum, Psion has so far preferred to concentrate on simulations and what Kelly calls more refined games.

"We have never really gone into arcade games, mainly because they have to be very good to get anywhere. Jet Set Willy and the Ultimate stuff has set an amazing precedent. If you produce an arcade game you have to produce it quickly. We do not have the time to do it at the moment.



"Potter always wanted something extra. When Flight Simulation appeared there was nothing like it — the same with VU-3D and Scrabble. With an arcade game you can always say 'there is something like that, it is not original' ".

The game on which Kelly and Psion are working at present is a simulation of a tennis match. The graphics I saw were impressive, with very realistic tennis strokes. According to Kelly, the main difficulty is how to move a player round the screen and also specify particular types of shot with a single joystick.

The background picture of the tennis court is most attractive and instantly-recognisable to Wimbledon enthusiasts. Kelly says the company would like to call the game Wimbledon rather than Tennis, but the All England Club which stages the tournament is not enthusiastic about having it august name linked to a computer game, although it assisted by providing action photographs.

He was coy as to whether Psion plans to write games for the QL but said there were ideas floating around.

He does think the machine would be ideal for an adventure game. "I would love to write one and the QL is the machine for an adventure. With two Microdrives and 128K of RAM, you don't need other attributes for an adventure but so far as Psion writing an adventure goes, I do not know."

His enthusiasm for the QL seems to have left his admiration of the Spectrum undimmed.

"It is perfect as a games machine. People talk about buying programs for the Atari costing £29 and say 'but they are better than the Spectrum games'. I do not think that is true nowadays. You can get just as good a program for the Spectrum. Atari has a tennis game but ours will be as good as that."

He enjoys programming for the Spectrum Z-80 processor but he has a few criticisms of the Sinclair implementation.

"It has a fantastic instruction set but why did Sinclair do the screen the way he did? I will never forgive him. It has a crazy screen organisation which makes my job difficult so far as speed is concerned. The sound is sickening as well but I stay away from the hardware," he says.

Kelly feels lucky to have entered the software industry when he did. He thinks the days of the individual games designer are over. At Psion he uses a Digital VAX for all the games programming and says games of today's complexity and quality could not be programmed sitting at home on a Spectrum.

He believes the idea of a generation of children making millions with their computer skills is a myth. "I don't know much about how it affects children in schools but I know a kid who had a computer for Christmas and he spent the whole time in front of the television with it. It might be like any toy. You get something for Christmas; you huddle in a corner with it and play with it for ages, then leave it.

According to Kelly, parents are becoming much more involved than the children for whom the machines were bought.

"I know another kid who had a Spectrum for his birthday but he has not even attempted to learn programming. He has just bought a few games but his father is getting really into it. It seems to be the adults who are interested in learning. I suppose the kids get a bellyful at school."

Kelly hopes young people get a break like he did.

"Everything is getting multi-multi nowadays and the little person may be left out of it more but I think those people may be able to prove themselves anyway. They should still be able to go to a big company with a program and say 'Look what I've done' and the managing director will be impressed," he says.

Kelly obviously enjoys working for Psion and is full of praise for his employers. Was there a glimmer of regret at having turned professional and perhaps lost some of the fun of playing games?

"I have a Spectrum at home but I cannot handle playing it at night now. I used to play it a great deal — games like Manic Miner — but unless it is absolutely necessary I avoid touching it at home," he says.

Kelly has gone a long way from Warrington in the last three years. As far as losing his hobby is concerned, he says it is a fair swap.



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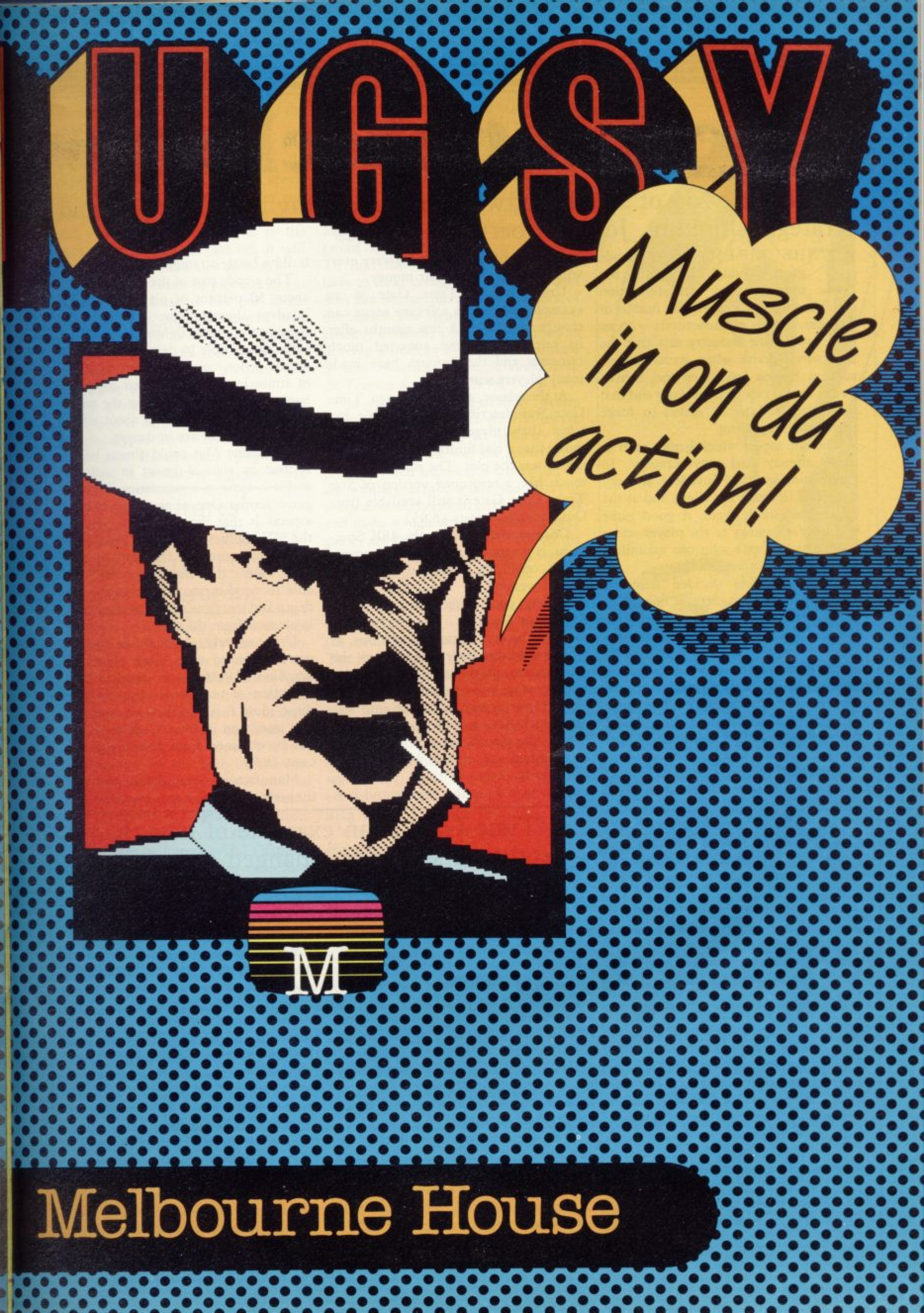
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The plot thickens

The frantic zap of arcade software has given way to calmer play and strategic thinking. John Gilbert investigates

THE 'ZAP-EM' type of arcade game, although still around, has undergone a transformation which started in earnest in the middle of last year. Games manufacturers with an eagle eye on the industry saw that the time would arrive when arcade games, such as **Space Invaders** and **Centipede,** would fade in popularity and that something had to be added to make them more appealing.

The one aspect which games such as those already had was strategy. In games such as Space Invaders, strategy is needed to evade the aliens and at the same time fire at them. A good game will infer a strategy to the player and a good player is one who can assimilate that method of play quickly.

Software houses decided that the most obvious way to increase interest in the arcade style of game was to emphasise the strategy aspect. That is done either by putting strategy games in an arcade format or by slowing the action to accommodate structured thought instead of quick-fire intuition. The move worked well and games like **Time Gate, Stonkers** and **Codename Mat** prove it.

Time Gate reached the market shortly after the Spectrum arrived in great quantities and it is one of the first games for the machine produced by Quicksilva. The game centres on a conflict between the peoples of the free universe and the incredibly evil and ancient race of Squarm.

At the launch Quicksilva promoted it as the ultimate sci-fi space adventure and, with its 3D representation of space through the window of a fighter and the depth of story deadline, it was at that time.

The strategy of the game is centred on finding the aliens using the instrument panel of your spaceship and then destroying them. It was given added depth by spreading the Squarm through space and time so that the player has to lock-on to a particular sector in space and spacewarp there.

In some ways Quicksilva produced a game which crosses Space Invaders with the mainframe computer game **Star Trek.** It was that aspect initially which drew customers who wanted something different and who were ever-willing to part with their money.

Unfortunately, Time Gate is an example of how the software scene can change overnight. A few months after its release the game attracted much criticism and the Squarm have made many players squirm.

At the release, about a year ago, Time Gate was described as incredible but since then players and critics alike found that it had limitations, not least of which was the plot. The storyline is too much like a revamped version of Star Trek. Time Gate is still available from Quicksilva and costs £6.95.

Codename Mat, for the 48K Spectrum, is a new release from Micromega which could be described as an advanced version of Time Gate or an extremely good interpretation of the Atari **Star Raiders.** The strategy element in the arcade game is obvious, as you have to plot your way through the solar system, passing through star gates to spacewarp into another system.

The solar system is broken into sectors which have a planet or satellite as bases. The planets are taken from our solar system and include Mars, Jupiter and Earth. Each of those planets is under attack from the Myons and it is your job, as a teenager with the knowledge of the universe, to stop them.

There are two levels of play depending whether you want to use a lone ship or whether you want to be the commander of a task force. The latter is the most difficult as you can engage in several conflicts at the same time by using subspace radio, which seems to have an immediate effect on the sector you have selected.

If all your ships in one sector are destroyed, the planet could be destroyed and you have lost part of the game. If you see the situation where you could lose ships in another sector you will need to use your cunning and skill to build a battle strategy.

The arcade part of the game occupies about 50 percent of playing time and involves shooting through space and chasing the enemy fighters and motherships. It can only be described as classic arcade action combined with moments of strategic thinking to scan computer banks for information about the movement of hostile craft and about which planetary system are in danger.

Codename Mat could almost be described as state-of-the-art in software and it is close to a simulation in space-game terms. One of the most notable aspects is that the routine to generate the 3D graphics is only 200 bytes long. The compactness of the graphics routines means that the author has been able to concentrate on developing the depth and storyline of the game and that is obvious from the start.

Unfortunately, although the game is more advanced than Time Gate, the storyline is weak, as it seems to be a collection of unoriginal ideas. Luckily those ideas fuse together well and the plot stands on its own. Codename Mat can be obtained from Micromega and costs £6.95.

Manufacturers and authors have not limited arcade strategy games to the depths of space. They have also done the opposite of giving arcade games a touch of strategy and given strategy games on arcade feel.

> 'Time Gate is an example of how the software scene has changed overnight. A few months after its release the game attracted criticism'

Stonkers, for the 48K Spectrum from Imagine, is a prime example of that type of game. The player is given command of land-based forces, including tanks and infantry, which are grouped in the top right-hand corner of the screen. The enemy is based across the river on the other side of the screen and to reach a suitable combat position one or other side has to cross the bridge.

When you start to play, a map of the whole theatre of war is displayed. You can issue commands to active units on

the map by positioning a cursor over the map position you require.

One of two actions will occur. If you are on the big map you will zoom in to a detailed display of the location specified. If you are already zoomed in you can position the cursor over a fighting unit and by moving the cursor to the position you want it to take up, it will start to move towards that locality.

The use of a cursor to plot strategy is inventive and Imagine has put much effort into the game. It should take weeks for a player to work out a plan of strategy to defeat the foe, mainly because of the immense landscape on which play takes place.

The game is a cross between the usual type of battle strategy game such as **Apocalypse** from Red Shift and the arcade game **Battlezone.** Imagine has succeeded in producing a game which combines arcade quality graphics and strategic action. Stonkers can be obtained from Imagine for £3.95.

adventures' 'Halls of the Things started the craze for all-graphic

Maze games, such as **Pac-man,** have not escaped the eye of software houses keen to think of new plots. The munch-munch of the Pac-Man has been replaced by ponderings, such as 'Where is the treasure?' of the hero or heroine. That type of game is well-illustrated with such programs as **Ant Attack,** from Quicksilva, **Maziacs** from dk'Tronics and the irrepressible **Halls of the Things** from Crystal Computing, which still seems to be out-selling everything on the market.

Halls of the Things, in which the player has to collect a certain number of rings of power in a maze before being destroyed by the monsters, started a craze for the so called all-graphics adventures in which cartoon-style arcade graphics were combined with adventure plots. Most of those games take place in dungeons and feature magic and sword play. Several companies have followed the excellent crystal game, although unlike the state of play with arcade games nobody has copied original Crystal ideas as the area is so rich in concept material. Halls of the Things can be obtained from Crystal Computing and costs £7.50.

Maziacs, for the 48K Spectrum, is from dk'Tronics and is another example of the genre. It has a different graphics style from Halls of the Things which some would say is bolder and better and is more in line with the graphics which Ultimate Play the Game produces.

The plot involves finding a treasure chest in a maze which you must drag back home without being killed by the Maziacs, which can get into terrible sword fights with your player-character. To find the way to the treasure you have to make contact with the prisoners who are strung along the corridors of the maze. The fight sequences are incredibly detailed. You will again need to develop a strategy over a period of time to win. Maziacs can be obtained from dk'Tronics and costs £6.95.

To succeed, arcade-strategy games must produce an effect for the player like that produced by an ordinary zap-'em game. It is the way the addiction is created which makes the difference. In an ordinary arcade game the effect is created through a need to destroy aliens and make a high score. Arcade-strategy games are different, as they rely on the user's mind. It is the strategy as well as the graphics which keeps the player returning for more.

The combination of arcade techniques and strategic thinking has made the arcade-strategy game very popular. The insurgence of that type of program means that the customer has two types of game in one and the reality of the plot, through the realism of the arcade graphics, takes the games industry one step forward. The main criticism for a long time is liable to be that the plots on which the games hang are not original enough. We are, however, just beginning to see a change in arcade style, where bang and zap are replaced by plot and thought.

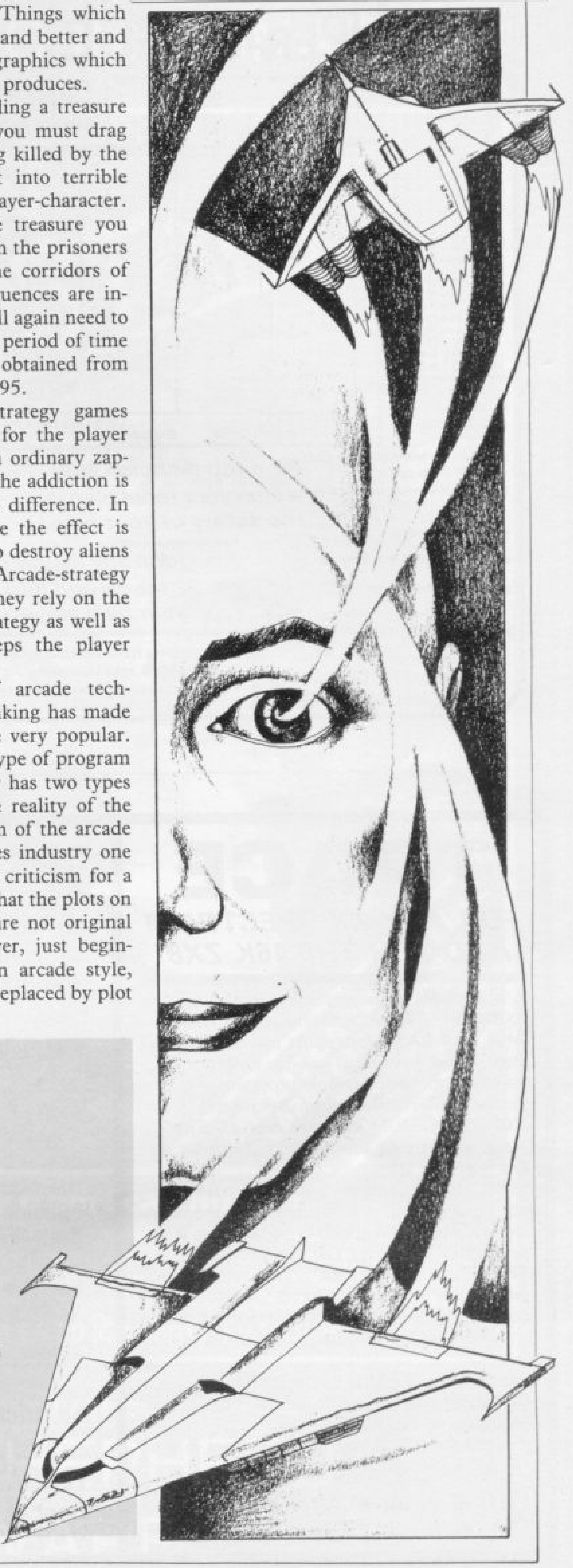
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Beaky and the Eggsnatchers is available for 48K Spectrum and Commodore 64 at £6.50 on cassette or on disk for the Commodore 64 at £9.50 from

FANTASY SOFTWARE, FAUCONBERG LODGE, 27A ST GEORGES ROAD, CHELTENHAM, GLOS GL50 3DT

despatched by return first class post together with free membership of the Fantasy Micro Club.

Trade Enquiries welcome — telephone 0242-583661.

PROGRAM PRINTOUT

Instructions for graphics characters are printed in lower-case letters in our listings. They are enclosed by brackets and separated by colons to distinguish them and the brackets and colons should not be entered.

Inverse characters are represented by the letter "i" and graphics characters by "g". Thus an inverse W would be represented by "iw", a graphics W by "gw", and an inverse graphics W by "igw".

Spaces are represented by "sp" and inverse spaces by "isp". Whenever any character is to be used more than once, the number of times it is to be used is shown before it, together with a multiplication sign. Thus "6*isp" means six inverse spaces and "(g4:4*i4:g3)" would be entered as a graphic four, followed by an inverse four repeated four times, followed by a graphics three.

Where whole words are to be written in inverse letters they appear in the listings as lower-case letters. Letters to be entered in graphics mode on the Spectrum are underlined.

Inverse characters may be entered on the ZX-81 by changing to graphics mode and then typing the appropriate characters and on the Spectrum by changing to inverse video and typing the appropriate letters. Graphics characters may be entered on the ZX-81 by changing to graphics mode and then pressing symbol shift while the appropriate characters are entered. On the Spectrum graphics characters may be obtained by changing to graphics mode and then pressing the appropriate character. User-defined graphics will appear as normal letters until the program has been RUN.

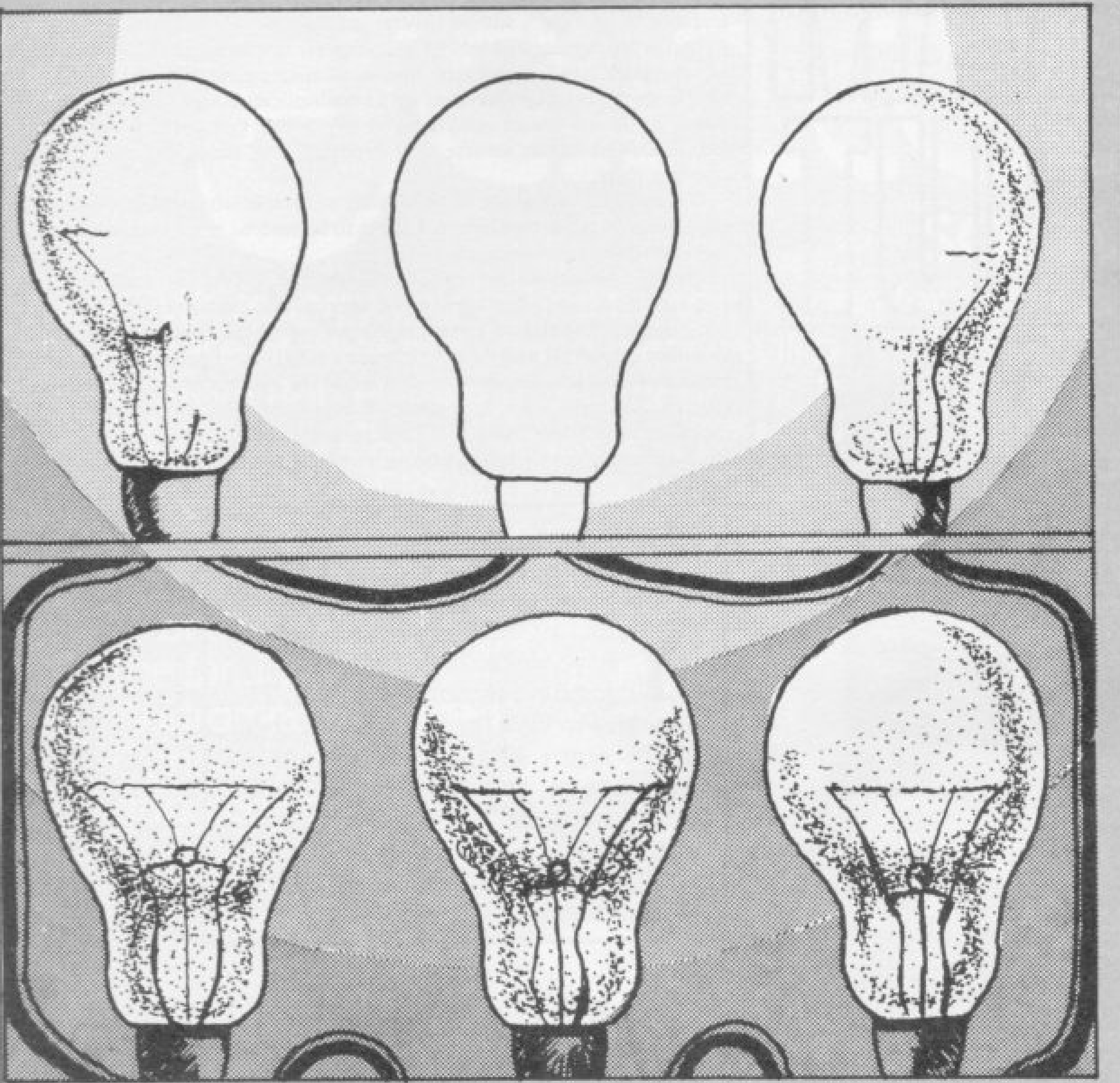


YOU CONTROL a stretcher and have to catch the people jumping from the burning tower. The only way to save them is to catch them in the centre of the stretcher so that they bounce into the ambulance. Be careful not to kill an ambulance man.

Ambulance was written for the 16K ZX-81 by C Morton of Morpeth, Northumberland.

AMBULANCE

```
  30 PRINT AT 0,11;"AMBULANCE"
  31 PRINT AT 1,11;"---------"
  32 PRINT " YOU MUST GUIDE THE
STRETCHER"
  33 PRINT "AND BOUNCE THE PEOPL
E (*),FROM "
  34 PRINT "FROM THE BURNING BUI
LDING TO THE"
  35 PRINT "AMBULANCE.(5=LEFT  8
=RIGHT)"
  36 PRINT " YOU LOSE IF 5 PEOPL
E OR 3"
  37 PRINT "AMBULANCEMEN DIE."
  38 PRINT " YOU MUST NOT GO TOO
 CLOSE TO   THE BUILDING OR AMBU
LANCE."
  40 PRINT AT 20,10;"PRESS N/L T
O PLAY"
  50 INPUT A$
  60 CLS
  97 LET HS=0
  99 LET Q=0
 100 FOR A=4 TO 20
 110 PRINT AT A,0;"█"
 120 PRINT AT A,1;"█"
 130 NEXT A
 131 PRINT AT 0,2;"DEAD=0"
 132 LET M=3
 133 PRINT AT 0,26;"MEN=";M
 134 LET S=0
 135 LET Z=0
 137 PRINT AT 0,14;"SAVED=";S
 140 PRINT AT 21,0;"███████████
█████████████████████"
 150 PRINT AT 18,28;"▄▄▄";AT 19,
28;"█+█";AT 20,28;"▀▀▀"
 190 LET A=INT (RND*10)+4
 191 LET B=2
 192 IF S>10 THEN LET A=INT (RND
*9)+9
 193 LET E=0
 194 LET D=0
 195 LET F=1
 197 IF Z=1 THEN GOTO 220
 200 LET X=20
 210 LET Y=14
 220 PRINT AT X,Y-2;" ▀▀▀ "
 222 IF Y=3 THEN GOTO 800
 224 IF Y=26 THEN GOTO 850
 230 PRINT AT A,B;"*";AT D,E;" "
 231 LET D=A
 232 LET E=B
 233 IF A=20 AND B=Y THEN GOTO 4
00
 236 IF A=20 THEN GOTO 700
 240 LET A=A+1
 250 LET B=B+1
 260 LET Y=Y+(INKEY$="8")-(INKEY
$="5")
 270 GOTO 220
 400 LET C=1
 401 LET D=A
 402 LET E=B
 403 PRINT AT 20,Y;"▀"
 407 LET A=A-C
 410 LET B=B+F
 420 PRINT AT A,B;"*";AT D,E;" "
 425 IF B=27 OR B=26 THEN LET C=
0
 426 IF A=13 THEN LET C=0
 427 IF B=28 THEN LET C=-1
 428 IF B=29 THEN LET F=0
 429 IF B=29 AND A=19 THEN GOTO
500
 430 GOTO 401
 500 LET S=S+1
 505 PRINT AT 0,14;"SAVED=";S
 507 PRINT AT 19,29;"+";AT 18,29
;"▀"
 515 LET Z=1
 520 GOTO 190
 700 PRINT AT 18,B-2;"SPLAT"
 701 IF B=Y-1 OR B=Y+1 THEN GOTO
703
 702 GOTO 740
 703 LET M=M-1
 704 PRINT AT 0,30;M
 705 IF M=0 THEN GOTO 750
 706 PRINT AT 15,3;"YOU KILLED A
N AMBULANCEMAN"
 709 IF B=Y+1 THEN GOTO 730
 712 LET H=4
 714 PRINT AT 20,H;" █"
 716 LET H=H+1
 718 IF H=Y-1 THEN GOTO 740
 720 GOTO 714
 730 LET H=26
 731 PRINT AT 20,H;"█ "
 732 LET H=H-1
 733 IF H=Y THEN GOTO 740
 734 GOTO 731
 740 FOR P=1 TO 25
 741 NEXT P
 742 LET Q=Q+1
 743 LET Z=1
 744 PRINT AT 18,B-2;"     "
 745 PRINT AT 15,3;"
"
 746 PRINT AT 0,2;"DEAD=";Q
 747 IF Q=5 THEN GOTO 750
 748 IF B<>Y-1 AND B<>Y+1 THEN P
RINT AT 20,B;" "
 749 GOTO 190
 750 IF S>HS THEN LET HS=S
 756 PRINT AT 3,8;"YOU SAVED ";S
;" PEOPLE.";AT 6,12;"HIGH SCORE=
";HS
 758 PRINT AT 8,9;"ANOTHER GAME?
 Y/N"
 760 IF INKEY$="N" THEN NEW
 765 IF INKEY$<>"Y" THEN GOTO 76
0
 770 CLS
 780 GOTO 98
 800 PRINT AT 4,4;"YOU WENT TOO
CLOSE TO THE"
 810 PRINT AT 5,3;"BUILDING AND
BURNT TO DEATH"
 820 GOTO 750
 850 PRINT AT 4,4;"YOU FORSOOK T
HE NEEDY,YOU";AT 5,3;"WILL NOT C
ATCH ANYONE THERE"
 860 GOTO 750
1000 SAVE "AMBULANCE"
1010 RUN
```



LIGHT-BULBS

LIGHTBULBS is a game for two players written for the 16K Spectrum by N Higson of Heaton, Bolton.

A cannon runs along the bottom of the screen and the players take turn to fire at the target. When the cannon runs from left to right the player on the left fires and when it runs from right to left the player on the right fires. The object of **Lightbulbs** is to be the first person to light six bulbs.

```
   2 BORDER 0: PAPER 0: INK 7: C
LS
   6 GO SUB 5000
   8 GO TO 4000
  10 BORDER 0: PAPER 0: CLS
  20 FOR h=3 TO 21
  30 PRINT  INK 7; AT h,0;"H"; A
T h,31;"J"
  40 NEXT h
  50 PRINT  AT 21,0; INK 0; PAPE
R 2;"IIIIIIIIIIIIIIIIIIIIIIIIIII
IIIII"
  60 LET p=0: LET b=0: LET t=0

 100 PRINT  AT 0,0;"
                "
 102 PRINT  INK 4; FLASH 1; AT 0
,14;a$
 109 PRINT  AT 2,t;" ": LET t= I
NT ( RND *24)+4: PRINT  INK 4; A
T 2,t;"C"
 110 FOR f=3 TO 28: PRINT  INK 4
; AT 20,f-1;" A"
 120 IF  INKEY$ ="1" THEN  GO TO
 150
 130 BEEP .02,f
 140 NEXT f: GO TO 1000
 150 FOR g=20 TO 1 STEP -1
 160 PRINT  INK 4; AT g,f;"B"
 170 BEEP .05,g
 180 PRINT  AT g,f;" "
 190 NEXT g
 200 IF f <> t THEN  GO TO 1000

 205 LET b=b+1
 210 FOR a=0 TO 30
 220 BEEP .01,a
 230 NEXT a
 240 IF b>0 THEN  PRINT  INK 1;
AT 4,1;"DE"; AT 5,1;"FG"
 250 IF b>1 THEN  PRINT  INK 2;
AT 7,1;"DE"; AT 8,1;"FG"
 260 IF b>2 THEN  PRINT  INK 3;
AT 10,1;"DE"; AT 11,1;"FG"
 270 IF b>3 THEN  PRINT  INK 4;
AT 13,1;"DE"; AT 14,1;"FG"
 280 IF b>4 THEN  PRINT  INK 5;
AT 16,1;"DE"; AT 17,1;"FG"
 290 IF b>5 THEN  PRINT  INK 6;
AT 19,1;"DE"; AT 20,1;"FG"
 295 IF b>5 THEN  GO TO 2000
1000 PRINT  AT 0,0;"
                "
1002 PRINT  INK 5; FLASH 1; AT 0
,14;b$
1009 PRINT  AT 2,t;" ": LET t= I
NT ( RND *24)+4: PRINT  INK 5; A
T 2,t;"C"
1010 FOR f=28 TO 3 STEP -1: PRIN
T  INK 5; AT 20,f;"A "
1020 IF  INKEY$ ="0" THEN  GO TO
 1060
1030 BEEP .02,f
1040 NEXT f: GO TO 100
1060 FOR g=20 TO 1 STEP -1
1070 PRINT  INK 5; AT g,f;"B"
1080 BEEP .05,g
1090 PRINT  AT g,f;" "
1100 NEXT g
1110 IF f <> t THEN  GO TO 100

1115 LET p=p+1
1120 FOR u=0 TO 30
1130 BEEP .01,u
1140 NEXT u
1150 IF p>0 THEN  PRINT  INK 1;
AT 4,29;"DE"; AT 5,29;"FG"
1160 IF p>1 THEN  PRINT  INK 2;
AT 7,29;"DE"; AT 8,29;"FG"
1170 IF p>2 THEN  PRINT  INK 3;
AT 10,29;"DE"; AT 11,29;"FG"
1180 IF p>3 THEN  PRINT  INK 4;
AT 13,29;"DE"; AT 14,29;"FG"
1190 IF p>4 THEN  PRINT  INK 5;

AT 16,29;"DE"; AT 17,29;"FG"
1200 IF p>5 THEN  PRINT  INK 6;

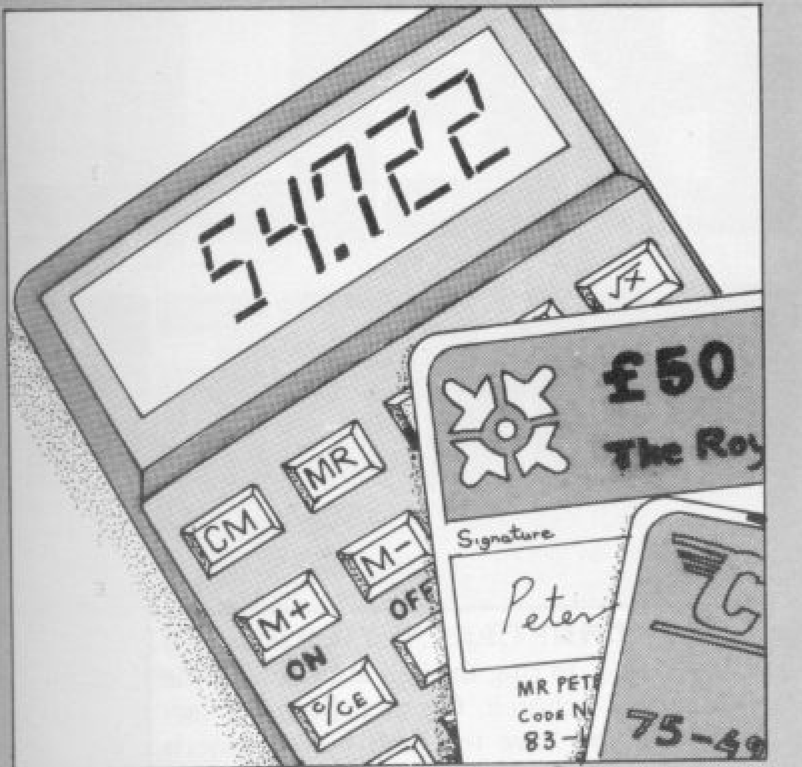
AT 19,29;"DE"; AT 20,29;"FG"
1205 IF p>5 THEN  GO TO 2000
1210 GO TO 100
2000 FOR m=0 TO 30
```

```
2020 BEEP .050,m
2023 NEXT m
2031 BORDER 0: PAPER 0: CLS
2033 IF b>5 THEN  PRINT  INK 6;
FLASH 1; AT 8,10;a$;" WINS."
2034 IF p>5 THEN  PRINT  INK 6;
FLASH 1; AT 8,10;b$;" WINS."
2035 FOR b=0 TO 10
2036 FOR a=0 TO 7
2038 PRINT  INK a; AT 5,3;"G A M
 E  O V E R"
2040 BORDER  RND *7: BEEP .025,
RND *55
2041 NEXT a
2042 BEEP .025, RND *55
2043 PRINT  INK 6; FLASH 1; AT 1
0,8;"CONGRATULATIONS"
2045 NEXT b
2060 GO TO 4050

4000 BORDER 0: PAPER 0
4005 PRINT  INK 6; FLASH 1; AT 0
,11;"LIGHTBULB"
4020 PRINT  INK 4;'"This is a ga
me for 2 people, theobject of th
e game is to light  the 6 light
bulbs on your side  of the scree
n.                 "
4030 PRINT  INK 4;'"The way you
do this is to hit   the target w
hich appears at the top of the s
creen at a random   spot.
                    "
4040 PRINT  INK 4;"At the bottom
 of the screen you will see a ca
nnon, when this     runs from lef
t to right, the     person on the
 left will fire by pressing (1)
when it runs from  right to left
 the person on the right will fi
re by pressing (0)."
4050 PRINT  INK 3; FLASH 1; AT 2
1,1;"PRESS ANY KEY TO INPUT PLAY
ERS"
4055 PRINT #1; INK 2; PAPER 6; F
LASH 1;"   (NOT MORE THAN 7 LETT
ERS.)   "
4056 PAUSE 0

4060 POKE 23658,8
4061 INPUT "ENTER NAME OF RIGHT
PLAYER ";a$
4062 IF  LEN a$>7 THEN  GO TO 40
61

4063 INPUT "ENTER NAME OF LEFT P
LAYER ";b$
4064 IF  LEN b$>7 THEN  GO TO 40
63
4070 GO TO 10
5000 FOR a= USR "a" TO  USR "j"+
7
5010 READ user: POKE a,user
5020 NEXT a
5030 DATA 24,24,24,24,24,60,255,
255
5040 DATA 24,24,24,24,24,60,60,3
6
5050 DATA 255,255,231,231,195,19
5,195,195
5060 DATA 3,15,63,127,127,255,25
5,255
5061 DATA 192,240,252,254,254,25
5,255,255
5062 DATA 255,255,255,127,127,63
,15,3
5063 DATA 255,255,255,254,254,25
2,240,192
5065 DATA 248,0,184,0,248,0,232,
0
5066 DATA 170,85,170,85,170,85,1
70,85
5067 DATA 31,0,29,0,31,0,23,0
5070 RETURN
```

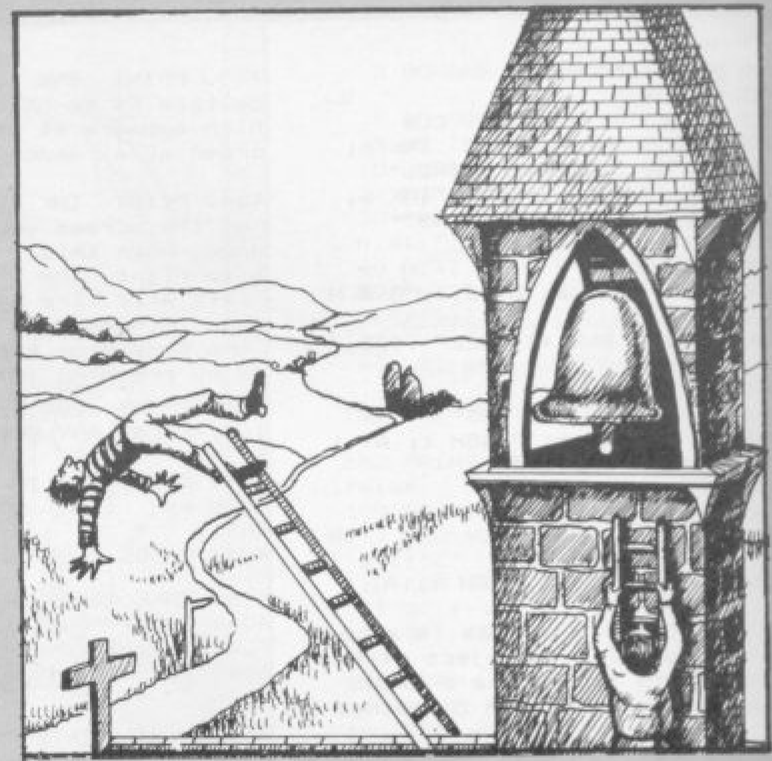


APR Calculator

THE PROGRAM is designed to enable you to work out your monthly repayments on items bought using plastic money. Enter the annual percentage rate and the cost of the item bought. The computer will work out the repayments and the number of months you have to repay the money, as well as the interest you will be charged.

APR Calculator was written for the 16K ZX-81 by Colin Moore, of Greenock, Renfrewshire.

```
   9 CLS
  10 PRINT AT 0,12;"A.P.R."
  20 PRINT AT 1,12;"▀▀▀▀▀▀"
  30 PRINT AT 3,0;"WHAT IS THE A
.P.R."
  40 INPUT APR
  50 PRINT AT 3,19;APR
  60 PRINT AT 5,0;"WHAT IS THE V
ALUE OF YOURE          PURCHASE"
  70 INPUT PUR
  80 PRINT AT 6,18;"£";PUR
 120 PRINT AT 10,0;"WHAT IS YOUR
 REPAYMENT"
 130 INPUT REP
 140 PRINT AT 10,24;"£";REP
 150 FOR Z=1 TO 100
 160 NEXT Z
 165 LET PURC=0
 170 CLS
 175 LET PURC=PUR
 180 LET INT=APR/12
 185 LET TCOS=0
 190 LET MON=0
 200 PRINT AT 0,0;"A.P.R.     =";A
PR
 210 PRINT AT 2,0;"VALUE     =£";
PUR
 220 PRINT AT 4,0;"REPAYMENT=£";
REP
 230 PRINT AT 6,10;"THINKING"
 235 LET INTR=(PUR/100)*INT
 240 LET BAL=(((PUR/100)*INT)+PU
R)-REP
 250 PRINT AT 6,10;"THINKING"
 255 LET PURC=PURC+INTR
 260 LET PUR=BAL
 270 PRINT AT 6,10;"THINKING"
 280 LET MON=MON+1
 290 PRINT AT 6,10;"THINKING"
 300 IF PUR<0 THEN GOTO 360
 310 PRINT AT 6,10;"THINKING"
 320 PRINT AT 6,10;"THINKING"
 330 PRINT AT 6,10;"THINKING"
 340 PRINT AT 6,10;"THINKING"
 350 GOTO 230
 360 PRINT AT 9,0;"YOUR PURCHASE
................"
 365 PRINT AT 11,0;"WILL COST YO
U    £";INT (PURC*100)/100
 370 PRINT AT 13,0;"IT WILL TAKE
 YOU ";MON;" MONTHS TO    PAY BAC
K"
 380 PRINT AT 16,0;"DO YOU WANT
TO DO ANOTHER          CALCULATION(
Y/N)"
 390 IF INKEY$="N" THEN STOP
 400 IF INKEY$="Y" THEN GOTO 9
 410 GOTO 390
```



BELL RINGER

THE OBJECT of **Bell Ringer** is to ring the bell at the top of the church. On each floor is a ladder you have to climb but as time is limited you have to drop down the holes to gain extra time and then race back up the ladder to the next floor. You have three lives but touching a red square will result in instant death.

Bell Ringer was written for the 16K Spectrum by Paul Spencer, aged 13, of Basford, Notts.

```
 10 FOR x=0 TO 7: READ b: POKE
USR "a"+x,b: NEXT x
 15 DATA 24,60,60,126,126,255,2
4,24
 20 FOR x=0 TO 7: READ b: POKE
USR "c"+x,b: NEXT x
 25 DATA 153,24,24,60,36,102,66
,195
 30 FOR x=0 TO 7: READ b: POKE
USR "b"+x,b: NEXT x
 35 DATA 8,8,8,8,8,8,8,8
 40 FOR x=0 TO 7: READ b: POKE
USR "f"+x,b: NEXT x
 45 DATA 20,62,42,62,20,20,54,1
19
 47 FOR x=0 TO 7: READ b: POKE
USR "d"+x,b: NEXT x
 48 DATA 124,4,4,4,124,4,4,4
 50 FOR x=0 TO 7: READ b: POKE
USR "e"+x,b: NEXT x
 55 DATA 63,32,32,32,63,32,32,3
2
 70 PRINT  AT 10,5;"(iD:iO:ig8:
iY:iO:iU:ig8:iW:iA:iN:iT:ig8:iI:
iN:iS:iT:iR:iU:iC:iT:iI:iO:iN:iS
:i?)"
 80 IF  INKEY$ ="y" THEN  GO TO
5000
 85 IF  INKEY$ ="n" THEN  GO TO
95
 90 GO TO 80
 95 CLS
100 LET t=3
110 LET s=0
120 LET a=11: LET b=19
130 BORDER 0: INK 7: PAPER 0
140 CLS
200 FOR p=0 TO 31
210 PRINT  AT 0,p;"(ig8)"
220 PRINT  AT 4,p;"(ig8)"
230 PRINT  AT 8,p;"(ig8)"
235 PRINT  AT 12,p;"(ig8)"
240 PRINT  AT 16,p;"(ig8)"
250 PRINT  AT 20,p;"(ig8)"
270 NEXT p
280 LET r=60
285 INK 2: PRINT  AT 16,5;"(ig8
)"
287 PRINT  AT 12,26;"(ig8)"
288 PRINT  AT 8,9;"(ig8)"
289 PRINT  AT 16,1;"  "
290 PRINT  AT 8,4;"  "
292 PRINT  AT 12,2;"  "
294 PRINT  AT 12,29;"  "
296 PRINT  AT 8,28;"  "
300 PRINT  AT 4,6;"  "
330 INK 5: PRINT  AT 17,28;"ED
                            ED
                            ED"
350 PRINT  AT 13,7;"ED
                    ED
                    ED"
360 PRINT  AT 9,23;"ED
                    ED
                    ED"
370 PRINT  AT 5,10;"ED
```

```
                          ED
                          ED"
380 INK 6: PRINT  AT 1,27;"B
                           A"
381 INK 4: PRINT  AT 15,4;"C"
382 PRINT  AT 11,27;"C"
383 PRINT  AT 7,8;"C"
384 GO SUB 750
385 IF t=0 THEN  GO TO 642
390 LET r=r-1
395 PRINT  AT 21,24;"TIME=";r
396 PRINT  AT 21,2;"SCORE=";s
397 IF r=9 THEN  PRINT  AT 21,3
0;" "
410 IF  INKEY$ ="8" THEN  LET a
=a+1
420 IF  INKEY$ ="5" THEN  LET a
=a-1
421 IF r=0 THEN : BEEP 3,1
422 IF r=0 THEN  LET t=t-1
423 IF r=0 THEN  LET r=65
430 INK 6: PRINT  AT b,a;"F"
440 PRINT  AT b,a+1;" "
450 PRINT  AT b,a-1;" "
454 IF a=30 THEN  PRINT  AT b,a
;" "
455 BEEP .01,15
460 IF a=28 AND b=19 OR a=29 AN
D b=19 OR a=7 AND b=15 OR a=8 AN
D b=15 OR a=23 AND b=11 OR a=24
AND b=11 OR a=10 AND b=7 OR a=11
 AND b=7 THEN  GO SUB 1000
470 IF b=3 AND a=27 THEN  GO SU
B 600
525 IF a=31 THEN  LET a=30
540 GO TO 330.
600 FOR x=0 TO 24
610 BEEP .06,x
620 NEXT x
630 LET s=s+500
635 LET t=t-1
642 IF t=0 THEN  PRINT  AT 21,0
;"(3*ig8:iW:iA:iN:iT:3*ig8:iA:iN
:iO:iT:iH:iE:iR:3*ig8:iG:iO:i?:3
*ig8)(Y/N)"
643 IF t=0 THEN  PRINT  AT 12,8
;"YOUR SCORE=";s
644 IF  INKEY$ ="n" THEN  STOP
646 IF t=0 AND  INKEY$ ="y" THE
N  RUN
647 IF t=0 THEN  GO TO 644
648 PAUSE 100
650 GO TO 120
750 IF b=15 AND a=5 THEN  LET t
=t-1
760 IF b=11 AND a=26 THEN  LET
t=t-1
```

```
770 IF b=7 AND a=9 THEN  LET t=
t-1
775 IF b=11 AND a=27 THEN  LET
r=70
780 IF b=7 AND a=8 OR b=15 AND
a=4 THEN  LET r=85
840 IF a=7 AND b=3 OR b=7 AND a
=5 OR b=11 AND a=3 OR b=15 AND a
=2 OR b=11 AND a=29 OR b=7 AND a
=28 THEN  GO TO 850
845 RETURN
850 FOR j=0 TO 3
855 PRINT  AT b,a;" "
860 LET b=b+1
870 PRINT  AT b,a;"F"
875 PAUSE 10
880 NEXT j
890 RETURN
1000 IF  INKEY$ ="0" THEN  GO TO
 1010
1005 RETURN
1010 FOR u=0 TO 3
1020 PRINT  AT b,a;" "
1030 LET b=b-1
1040 PRINT  AT b,a;"F"
1050 PAUSE 7
1060 NEXT u
1061 INK 7: PRINT  AT 12,7;"(ig8
)"
1062 PRINT  AT 8,23;"(ig8)"
1063 PRINT  AT 4,10;"(ig8)"
1064 PRINT  AT 16,29;"(ig8)"
1065 INK 7: PRINT  AT 16,28;"(ig
8)"
1066 PRINT  AT 4,11;"(ig8)"
1067 PRINT  AT 8,24;"(ig8)"
1068 PRINT  AT 12,8;"(ig8)"
1070 RETURN
5000 INK 4: PRINT  AT 3,0;"(5*ig
8)YOU MUST RING THE BELL AT(6*ig
8)THE TOP OF THE SCREEN BY(8*ig8
)RUNNING ALONG THE FLOORS(8*ig8)
CLIMBING UP THE LADDERS(9*ig8)AN
D DROPPING THROUGH THE(8*ig8)HOL
ES. YOU DON'T GET(12*ig8)ENOUGH
TIME TO REACH THE(8*ig8)BELL SO
YOU MUST GET THE(8*ig8)THINGS TH
AT LOOK LIKE THIS(7*ig8)C(ig8).
THESE GIVE YOU MORE(8*ig8)TIME.
YOU GO FROM ONE TO(8*ig8)ANOTHER
.YOU CAN NOT GO(9*ig8)OVER THE
RED SQUARES SO(9*ig8)TO GET THE
C'SYOU MUST(9*ig8)DROP DOWN THE
HOLES.(14*ig8)PRESS  KEY 0 TO
START(5*ig8)"
5010 IF  INKEY$ ="0" THEN  GO TO
 5030
5020 GO TO 5010
5030 CLS
5040 GO TO 100
```

SPAC



ARTH'S oxygen barrier is under attack by the space spiders which fall from the webs. As each spider lands on the barrier it makes a hole and the oxygen leaks. You have to move along the barrier and fill the holes as they are made to prevent the oxygen running out. If a spider lands on you it will take you away and the game ends.

Space Spiders was written for the 16K Spectrum by Ian Wombwell, aged 13, of Durham City, Co Durham.

```
  1 REM SPIDERS
 10 DIM c(4): DIM A(8): DIM B(8
)
 20 FOR N=1 TO 4: LET A(N)= INT
 ( RND *5)+2: LET c(n)=a(n): NEX
T N
 21 LET B(1)=10: LET B(2)=15: L
ET B(3)=20: LET B(4)=5
 30 LET HISCORE=16840
 40 LET OXYGEN=1000
 50 LET SCORE=0
 60 LET HOLE=0
 70 LET X=15
 80 LET LONG=0
 90 LET COUNT=0
 99 REM Users Grafics
109 REM Spider1
110 FOR n=0 TO 7: READ a: POKE
 USR "p"+n,a: NEXT n: DATA  BIN
00011000, BIN 00111100, BIN 1101
1011, BIN 01011010, BIN 00111100
, BIN 01011010, BIN 01011010, BI
N 01100110
119 REM Spider2
120 FOR n=0 TO 7:: READ a: POKE
 USR "o"+n,a: NEXT n: DATA  BIN
 00011000, BIN 00111100, BIN 110
11011, BIN 01011010, BIN 0011110
0, BIN 01011010, BIN 10011001, B
IN 10011001
129 REM ME
130 FOR n=0 TO 7:: READ a: POKE
 USR "m"+n,a: NEXT n: DATA  BIN
 00010000, BIN 00010000, BIN 001
11000, BIN 01010100, BIN 1001001
0, BIN 01101100, BIN 01000100, B
IN 01111100
135 FOR n=0 TO 7:: READ a: POKE
 USR "k"+n,a: NEXT n: DATA  BIN
 00010000, BIN 00010000, BIN 001
11000, BIN 01010100, BIN 1001001
0, BIN 01101100, BIN 01000100, B
IN 011000110
139 REM BALL1
140 FOR n=0 TO 7:: READ a: POKE
 USR "B"+n,a: NEXT n: DATA  BIN
 00, BIN 0, BIN 00001000, BIN 00
011100, BIN 00111110, BIN 000111
00, BIN 00001000, BIN 0
149 REM BALL2
150 FOR n=0 TO 7:: READ a: POKE
 USR "G"+n,a: NEXT n: DATA  BIN
 00, BIN 00001000, BIN 00011100,
 BIN 00111110, BIN 01111111, BIN
 00111110, BIN 00011100, BIN 000
01000
159 REM STRING
160 FOR n=0 TO 7:: READ a: POKE
 USR "S"+n,a: NEXT n: DATA  BIN
 00011000, BIN 00011000, BIN 000
11000, BIN 00011000, BIN 0001100
0, BIN 00011000, BIN 00011000, B
IN 00011000
200 REM OUTPUT SCREEN
201 BORDER 0: PAPER 0: CLS : IN
K 7: BRIGHT 1:
202 INPUT "INSTRUCTIONS?";a$
203 IF a$="n" THEN  GO TO 205

204 PRINT  AT 0,0;"SAVE EARTHS
OXYGEN BARRIER FROM ATTACK BY TH
E SPACE SPIDERS WHICH FALL FROM
THERE WED. NOTE IF A HOLE IT HIT
 TWICE WITHOUT BEGIN FILL IN IT
WILL REMAIN FOR EVER
                USE KEY '1' LEFT
  'Ø' RIGHT   AND 'Q' TO F
ILL IN THE HOLES MADE BY THE SPA
IDERS.                AS YOU GET
 BETTER MORE SPIDER APPEAR"
205 PRINT "IF A SPIDER LANDES O
N YOU IT WILL TAKE YOU AWAY"
206 PRINT "EXPECT SOME PHONE CA
LLES"
207 INPUT "PRESS ENTER";A$: CLS
 : PRINT  FLASH 1; INK 2; PAPER
6; AT 0,0;"(ig5:g5:ig5:g5:ig5:g5
:ig5:g5:ig5)SPIDER ATTACK(ig5:g5
:ig5:g5:ig5:g5:ig5:g5:ig5)"
210 LET C=4: LET A=161: LET B=2
55/2
215 PLOT 0,A
220 DRAW  INK 7; PAPER 0;B,C
```



SPIDERS

```
 230 LET A=A-4: LET B=B-6: LET C
=C+4
 240 BEEP .001,50: IF C >= 85 TH
EN  GO TO 260
 250 GO TO 215
 260 LET C=4: LET A=161: LET B=-
255/2
 270 PLOT 255,A
 280 DRAW  INK 7; PAPER 0;B,C
 290 LET A=A-4: LET B=B+6: LET C
=C+4
 300 BEEP .001,50: IF C >= 85 TH
EN  GO TO 320
 310 GO TO 270
 320 PRINT  AT 0,0;"
                  ";: PRINT  I
NK 6; AT 0,10;"HISCORE=";HISCORE
; AT 21,0;"SCORE=";SCORE; AT 21,
21;"OXYGEN=";OXYGEN; AT 21,12;"H
OLES=";HOLE
 330 PRINT  INK 2; AT 20,0;"(32*
ig8)"
 499 REM MOVE SPIDERS
 500 FOR N=1 TO  INT LONG+1: LET
 LONG=LONG+.005: IF LONG >= 4 TH
EN  LET LONG=0: GO TO 3000
 501 IF a(n)=18 AND b(n)=x THEN
 GO TO 4000
 520 PRINT  PAPER 0; INK 6; AT A
(N),B(N);"S"
 530 LET A(N)=A(N)+1: IF A(N)=20
 THEN  PRINT  INK 7; PAPER 0; BR
IGHT 1; AT 20,B(N);"(ig8)": LET
HOLE=HOLE+1: LET A(N)= INT ( RND
 *6)+2: FOR M=19 TO c(n) STEP -1
: PRINT  AT M,B(N);" ": NEXT M:
LET B(N)= INT ( RND *31): LET c(
n)=a(n)
 545 LET A$="O": IF A(N)/2= INT
(A(N)/2) THEN  LET A$="P"
 550 PRINT  INK 6; AT A(N),B(N);
A$
 600 REM MOVE ME
 610 PRINT  AT 19,X;" ": IF  INK
EY$ ="1" AND X>0 THEN  LET X=X-1

 620 IF  INKEY$ ="0" AND X<31 TH
EN  LET X=X+1
 625 LET b$="K": IF x/2= INT (x/
2) THEN  LET b$="M"
 630 PRINT  AT 19,X;b$
 640 LET SCORE=SCORE+OXYGEN/100:
 LET OXYGEN=OXYGEN-HOLE*5: LET S
CORE= INT (SCORE): PRINT  AT 21,
6;SCORE; AT 21,19;HOLE; AT 21,28
;OXYGEN
 650 IF  INKEY$ ="q" AND  ATTR (
20,X)=71 THEN  LET HOLE=HOLE-1:
PRINT  AT 20,x;"*": BEEP .01,0:
BEEP .01,5: BEEP .01,15: PRINT
AT 20,X;"B": BEEP .01,10: BEEP .
01,20: BEEP .01,30: PRINT  AT 20
,X;"G": BEEP .01,40: BEEP .01,50
: BEEP .01,60: PRINT  INK 2;
PAPER 2; AT 20,X;"(ig8)"
 660 IF OXYGEN <= 0 THEN  GO TO
2000
1000 NEXT N: GO TO 500
2000 FOR M=0 TO 10 STEP 10: FOR
N=0 TO 23: PRINT  AT M,N;"    (2
*ig8)"
2001 IF score>hiscore THEN  BEEP
 1,10: PRINT  AT 11,10;"YOU ARE
A HERO"
2010 PRINT  AT M+1,N;"  (6*ig8)"

2020 PRINT  AT M+2,N;" (2*ig8:sp
:2*ig8:sp:2*ig8)"
2030 PRINT  AT M+3,N;"  (6*ig8)"

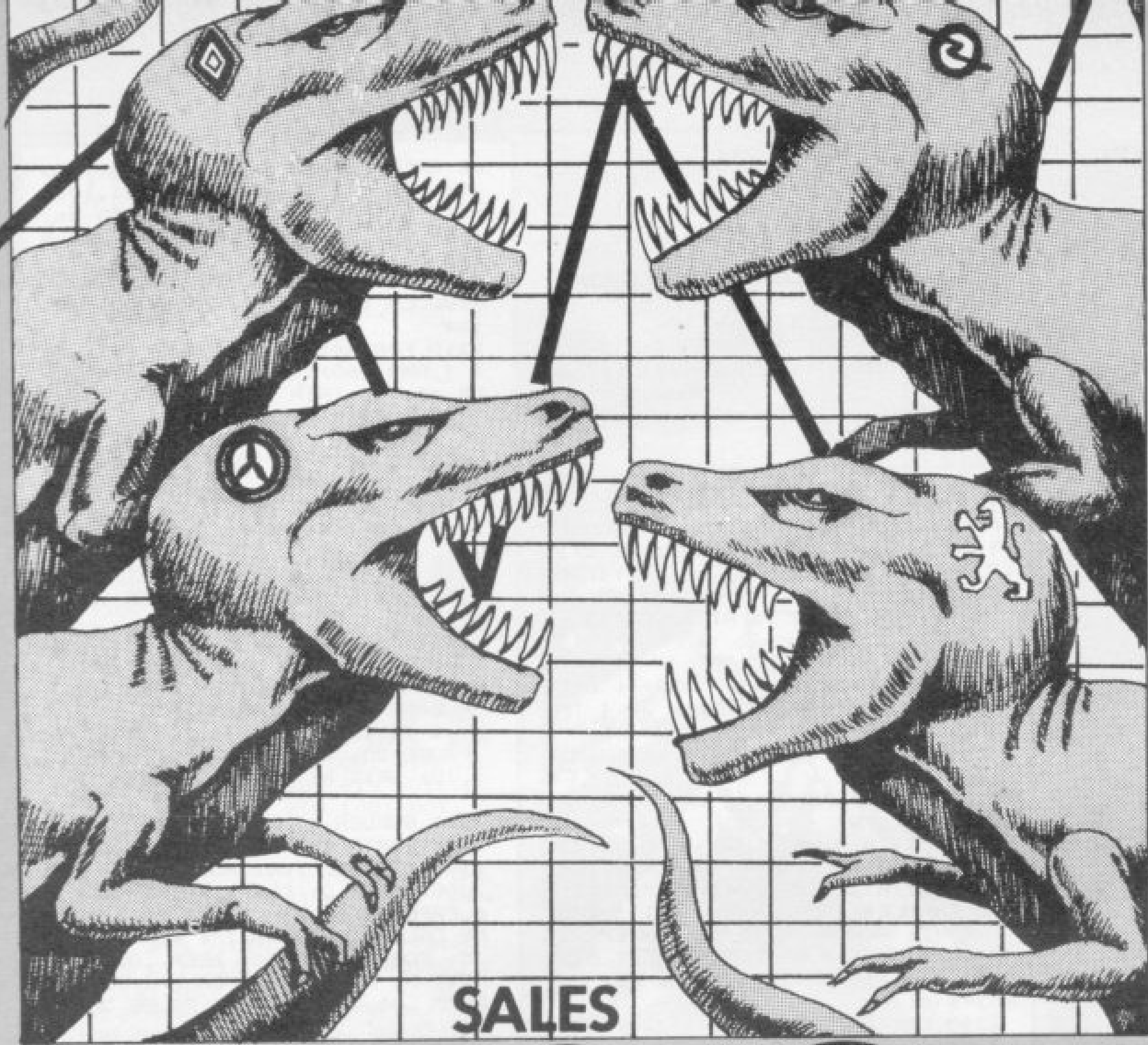
2040 PRINT  AT M+4,N;"  (ig8:sp:
2*ig8:sp:ig8) "
2050 PRINT  AT M+5,N;" (ig8:2*sp
:2*ig8:2*sp:ig8) "
2060 PRINT  AT M+6,N;" (ig8:2*sp
:2*ig8:2*sp:ig8) "
2070 PRINT  AT M+7,N;"  (ig8:sp:
2*ig8:sp:ig8) "
2080 BEEP .001,N+40: BEEP .001,N
+40: BEEP .001,M+30: BEEP .001,M
+30: NEXT N: NEXT M
2090 PAPER 2: CLS : PRINT  INK 6
; PAPER 2; FLASH 1; AT 10,5;"PHO
NE CALL PLEASE WAIT": FOR M=1 TO
 5: FOR N=1 TO 10: BEEP .01,10:
NEXT N: PAUSE 20: FOR N=1 TO 5:
BEEP .01,10: NEXT N: PAUSE 20: N
EXT M
2100 INPUT "PHONE CALL FROM EART
H:WOULD YOU LIKE ANOTHER GO Y/N"
;a$
2110 FOR n=1 TO 40: BEEP .01, IN
T ( RND *60): NEXT n: IF a$="y"
OR a$="Y" THEN  GO TO 2200
2115 PRINT  INK 6; PAPER 2; FLAS
H 1; AT 10,0;"ANOTHER PHONE CALL
 PLEASE WAIT": FOR M=1 TO 5: FOR
 N=1 TO 10: BEEP .01,10: NEXT N:
 PAUSE 20: FOR N=1 TO 5: BEEP .0
1,10: NEXT N: PAUSE 20: NEXT M

2120 BORDER 1: CLS : PRINT  AT 1
0,0;"EARTH THINKS A COWARD IS PL
AYING"
2130 GO TO 2130
2200 PRINT  INK 6; PAPER 2; FLAS
H 1; AT 10,0;"ANOTHER PHONE CALL
 PLEASE WAIT": FOR M=1 TO 5: FOR
 N=1 TO 10: BEEP .01,10: NEXT N:
 PAUSE 20: FOR N=1 TO 5: BEEP .0
1,10: NEXT N: PAUSE 20: NEXT M

2210 BORDER 1: CLS : PRINT  AT 1
0,0;"EARTH THINKS A HERO? IS PLA
YING": PAUSE 100: RUN
3000 PAPER 2: CLS : PRINT  INK 6
; PAPER 2; FLASH 1; AT 10,5;"PHO
NE CALL PLEASE WAIT": FOR M=1 TO
 5: FOR N=1 TO 10: BEEP .01,10:
NEXT N: PAUSE 20: FOR N=1 TO 5:
BEEP .01,10: NEXT N: PAUSE 20: N
EXT M
3010 PRINT  AT 10,0;"Earth ARE!
pleased and you are rewarded wit
h 400 units of exta oxygen": PAU
SE 200: LET oxygen=oxygen+400
3020 LET hole=0: CLS : GO TO 200

4000 FOR m=19 TO 0 STEP -1: PRIN
T  AT m+1,b(n);"M"; AT m,b(n);"O
"; AT m+2,b(n);" ": BEEP .001,n:
 BEEP .01,n: BEEP .01,n: BEEP .0
01,n: NEXT m
4100 GO TO 2000
```





OLIGOPOLY

OLIGOPOLY for the 48K Spectrum is the second in our series of listings of Cambridge Award winners. The game is for one to six players and each plays the boss of a company which is in competition with the others. Your objective is to create wealth at a faster rate than your competitors.

You will need to make decisions on production levels, selling price, marketing expenses and the level of dividends needed to keep your company afloat.

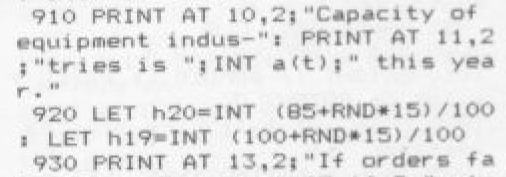
During the program you will be given news flashes about the state of the market, along with annual reports and forecasts. The computer will prompt for any information it requires but it will be for you to find the strategy to beat your competitors.

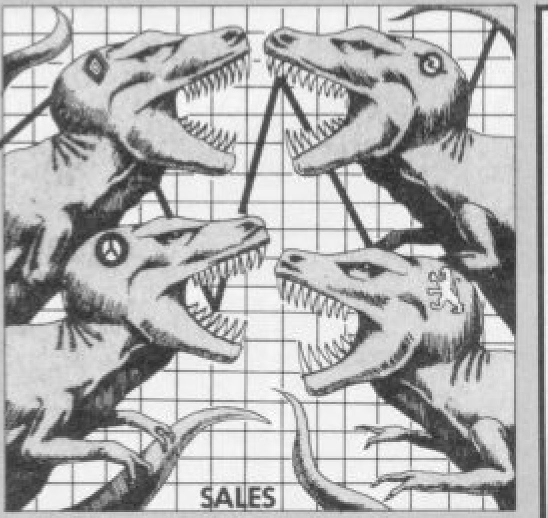
Oligopoly was written by N Holgate of Camberley, Surrey, and won third prize in the 1983 Cambridge Awards.

```
   1 BORDER 0: PAPER 0: INK 7:
CLS : GO SUB 9900
  40 BEEP 0.5,-5: BEEP .5,-3: BE
EP 1,0: BEEP .5,2: BEEP .17,5: B
EEP .17,4: BEEP .17,2: BEEP .5,4
: BEEP 1,7
  41 PAUSE 25
  42 BEEP 0.5,0: BEEP .75,12: BE
EP .25,9: BEEP .5,7: BEEP .5,5:
BEEP .5,7: BEEP .5,9
  43 PAUSE 25
  44 BEEP 0.5,0: BEEP .75,12: BE
EP .25,9: BEEP .5,7: BEEP .5,5:
BEEP .5,2: BEEP 1,0
  45 PAUSE 25
  46 BEEP 0.5,-5: BEEP .5,-3: BE
EP 1,0: BEEP .5,2: BEEP .17,5: B
EEP .17,4: BEEP .17,6: BEEP .5,4
: BEEP 1,7
  47 PAUSE 25
  48 BEEP 0.5,0: BEEP .75,7: BEE
P .25,4: BEEP .5,4: BEEP .75,5:
BEEP .25,4: BEEP .25,2: BEEP .25
,0: BEEP 1,2: BEEP .5,0: BEEP .5
,-1: BEEP 1,0
  50 POKE USR "A",255
  52 POKE USR "A"+1,127
  54 POKE USR "A"+2,63
  56 POKE USR "A"+3,31
  58 POKE USR "A"+4,15
  60 POKE USR "A"+5,7
  62 POKE USR "A"+6,3
  64 POKE USR "A"+7,1
  66 POKE USR "B",255
  68 POKE USR "B"+1,254
  70 POKE USR "B"+2,252
  72 POKE USR "B"+3,248
  74 POKE USR "B"+4,240
  76 POKE USR "B"+5,224
  78 POKE USR "B"+6,192
  80 POKE USR "B",128
  82 POKE USR "C",1
  84 POKE USR "C"+1,3
  86 POKE USR "C"+2,7
  88 POKE USR "C"+3,15
  90 POKE USR "C"+4,31
  92 POKE USR "C"+5,63
  94 POKE USR "C"+6,127
  95 POKE USR "C"+7,255: INK 0
 102 CLS : BORDER 6: PAPER 7: IN
K 1: CLS : PRINT AT 13,0;"How ma
ny firms are there in the
     industry ?": PRINT AT 18,0;
 FLASH 1;"(1 to 6)"
 103 IF INKEY$<>"" THEN  GO TO 1
03
 104 LET n$=INKEY$: IF n$="" THE
N  GO TO 104
 106 IF CODE n$<49 OR CODE n$>54
 THEN  GO TO 102
 108 LET n=VAL n$: LET n=INT (n+
.5): PRINT AT 21,n;n;" Firms.":
PAUSE 40: PAUSE 40: PAUSE 40: CL
S
 109 LET kk=0: LET x45=0
 115 IF n=1 THEN  LET kk=1: LET
n=2: PRINT AT 9,0;"Although you
are the only playerthe Spectrum
will run a rival   firm (number
2).": PAUSE 200: CLS : GO TO 127
 120 PRINT AT 9,0;"Each year eac
h firm must decide how to raise
its profits and thevalue of its
shares, taking ac- count of othe
r firms' decisions."
 125 PAUSE 400: CLS
 127 PRINT AT 8,0;"  Do you wish
 to use a printer ?
(y/n)": FOR x=1 TO 3: BEEP .05,1
0: BEEP .1,-10: BEEP .1,-15: NEX
T x: INPUT z$: CLS
 130 PRINT AT 8,0;"  How many ye
ars' would you like
to play ?": PRINT AT 18,0; FLASH
 1;"(2 to 25) "
 131 INPUT b$
 135 LET tt=VAL b$
 190 LET tt=INT (tt+0.5)
 200 IF tt>25 THEN  LET tt=25
 202 IF tt<2 THEN  LET tt=2
 205 PRINT AT 21,0;"No. of years
 = ";tt: PAUSE 20: PAUSE 20: PAU
SE 20: PAUSE 20: CLS
 210 DIM j(tt): DIM k(n): DIM l(
tt): DIM m(n,tt): DIM n(n,tt)::
DIM o(n,tt): DIM p(n,tt): DIM q(
n,tt): DIM r(n,tt): DIM s(n,tt):
 DIM t(n): DIM u(n,tt): DIM v(n,
tt): DIM w(n,tt): DIM x(tt): DIM
 y(n): DIM z(n,tt)
 220 DIM a(tt): DIM b(n,tt): DIM
 c(n): DIM d(n,tt): DIM e(n): DI
M f(n,tt): DIM g(n,tt): DIM h(n,
tt): DIM i(n,tt)
 225 LET p=n*10: LET tr=0.4: LET
 f1=0.15+RND/10: LET f2=0.225+RN
D/10: LET f3=1-f2-f1
 230 LET h1=1: LET h2=1: LET h3=
1: LET h4=1: LET h5=1: LET h6=1:
 LET h7=1: LET h8=1: LET h9=1: L
ET h10=1: LET h11=0: LET h12=0:
LET h13=0: LET h14=0: LET h15=0:
 LET h16=0: LET h17=0: LET h18=0
: LET h19=0: LET h20=0
 235 LET g=1: LET v=0: LET r=10
 265 DATA 66158,9458,5.67,10000,
10000,2500,7500,10000,10,13842,0
.05,1537,2305,12305,0,200000,212
305,0,10000
 290 LET t=1
 300 FOR k=1 TO n
 310 READ h(k,t),f(k,t),v(k,t),q
(k,t),i(k,t),r(k,t),m(k,t),s(k,t
),p(k,t),g(k,t),b(k,t),t(k),n(k,
t),e(k),k(k),c(k),u(k,t),d(k,t),
o(k,t)
 320 RESTORE 265
 330 NEXT k
 340 LET a(t)=n*o(1,1)*1.01
 502 FOR k=1 TO n: BRIGHT 1: BOR
DER k: BRIGHT 0: INK 0
 504 PRINT AT 0,0;"Firm ";k;AT 0
```

```
,25;"Year ";t: IF z$(1 TO 1)="y"
 OR z$(1 TO 1)="Y" THEN  INK 7
 506 INVERSE 1: PRINT AT 2,9;"Tr
ading Account": PRINT AT 2,26;"#
"
 508 IF u(k,t)=0 THEN  LET p(k,t
)=99: PRINT AT 4,0;"  Unfortunat
ely this firm is        bankrupt a
nd will not be          making any
 decisions !            ": PAUSE 120
: GO TO 730
 510 PRINT AT 4,2;"Sales": INVER
SE 0: PRINT AT 4,8;"(";INT (0.5+
s(k,t));" @ #";p(k,t);")": LET V
V=INT (s(k,t)*p(k,t)+.5): LET x$
=STR$ VV: PRINT AT 4,(29-LEN x$+
1);x$
 515 PRINT AT 5,24;"______"
 540 INVERSE 1: PRINT AT 6,2;"Pr
oduction": INVERSE 0: PRINT AT 6
,13;" (";q(k,t);")"
 545 PRINT AT 7,2;"Raw materials
,wages": LET x$=STR$ INT (h(k,t)
+.5): PRINT AT 7,(29-LEN x$+1);x
$: PRINT AT 8,24;"______"
 548 PRINT AT 9,2;"Contribution
to": PRINT AT 10,2;"overheads":
LET x$=STR$ INT ((s(k,t)*p(k,t)+
.5)-INT (h(k,t)+.5)): PRINT AT 1
0,(29-LEN x$+1);x$
 550 INVERSE 1: PRINT AT 12,2;"L
ess": INVERSE 0: PRINT AT 13,2;"
Marketing": LET x$=STR$ m(k,t):
PRINT AT 13,(23-LEN x$+1);x$
 555 PRINT AT 14,2;"R & D": LET
x$=STR$ r(k,t): PRINT AT 14,(23-
LEN x$+1);x$
 560 PRINT TAB 2;"Reps & Renewal
s": LET x$=STR$ INT (0.5+i(k,t))
: PRINT AT 15,(23-LEN x$+1);x$
 565 LET x$=STR$ (m(k,t)+r(k,t)+
INT (.5+i(k,t))): PRINT AT 16,(2
9-LEN x$+1);x$
 567 PRINT AT 17,24;"______"
 570 INVERSE 1: PRINT AT 19,2;"G
ross profit": INVERSE 0: IF g(k,
t)<0 AND z$(1 TO 1)<>"y" AND z$(
1 TO 1)<>"Y" THEN  INK 2
 575 LET x$=STR$ INT g(k,t): PRI
NT AT 19,(29-LEN x$+1);x$: IF z$
(1 TO 1)<>"y" AND z$(1 TO 1)<>"Y
" THEN  INK 0
 577 PRINT AT 20,24;"______"
 580 IF z$(1 TO 1)="y" OR z$(1 T
O 1)="Y" THEN  COPY
 585 IF z$<>"Y" AND z$(1 TO 1)<>
"y" THEN  PAUSE 50: PRINT AT 21,
1;"(Press any key to continue.)"
: PAUSE 850
 587 CLS : PRINT AT 0,0;"Firm ";
k;AT 0,25;"Year ";t
 588 INVERSE 1: PRINT AT 2,9;"Pr
ofit & Loss": PRINT AT 2,26;"#"
 590 PRINT AT 4,2;"Gross profit"
: INVERSE 0: IF g(k,t)<0 AND z$(
1 TO 1)<>"y" AND z$(1 TO 1)<>"Y"
 THEN  INK 2
 592 PRINT AT 4,(29-LEN x$+1);x$
: IF z$(1 TO 1)<>"Y" AND z$(1 TO
 1)<>"y" THEN  INK 0
 595 PRINT AT 5,24;"______": INV
ERSE 1: PRINT AT 7,2;"Accounting
 Costs": INVERSE 0: PRINT AT 9,2
;"Interest": IF w(k,t)<0 THEN  P
RINT AT 9,11;"earned"
 598 LET x$=STR$ INT (0.5+w(k,t)
): PRINT AT 9,(23-LEN x$+1);x$
 600 PRINT TAB 2;"Depreciation":
 LET x$=STR$ INT (0.5+o(k,t)): P
RINT AT 10,(23-LEN x$+1);x$
 605 PRINT TAB 2;"Tax": LET x$=S
TR$ INT (0.5+t(k)): PRINT AT 11,
(23-LEN x$+1);x$: IF t(k)<0 THEN
 PRINT AT 11,6;"refund"
 607 LET x$=STR$ (INT (g(k,t)-n(
k,t)+.5)): PRINT AT 12,(29-LEN x
$+1);x$: PRINT AT 13,24;"______"
 610 IF w(k,t)<0 OR t(k)<0 THEN
 PRINT AT 18,1;"(A 'negative' co
st such as a    tax refund is, o
f course,       income !)"
 612 INVERSE 1: PRINT AT 15,2;"N
et profit": INVERSE 0: IF n(k,t)
<0 AND z$(1 TO 1)<>"y" AND z$(1
TO 1)<>"Y" THEN  INK 2
 615 LET x$=STR$ INT (0.5+n(k,t)
): PRINT AT 15,(29-LEN x$+1);x$:
 IF z$(1 TO 1)<>"y" AND z$(1 TO
1)<>"Y" THEN  INK 0
 616 PRINT AT 16,24;"______": IF
 z$(1 TO 1)="Y" OR z$(1 TO 1)="y
" THEN  COPY : GO TO 618
 617 PAUSE 50: PRINT AT 21,1;"(P
ress any key to continue.)": PAU
SE 850
 618 CLS : PRINT AT 0,0;"Firm ";
k;AT 0,25;"Year ";t
 620 INVERSE 1: PRINT AT 3,10;"C
ash Flow": PRINT AT 3,26;"#": IN
VERSE 0
 625 PRINT AT 5,2;"Money in hand
": PRINT AT 6,2;" (Year ";t-1;")
": LET x$=STR$ INT (e(k)-n(k,t)-
o(k,t)+d(k,t)+.5): PRINT AT 6,(2
9-LEN x$+1);x$
 627 INVERSE 1: PRINT AT 8,2;"Pl
us": INVERSE 0: PRINT AT 10,2;"D
epreciation": LET x$=STR$ INT (.
5+o(k,t)): PRINT AT 10,(23-LEN x
$+1);x$
 628 PRINT AT 11,2;"Net profit":
 IF n(k,t)+.5<0 AND z$(1 TO 1)<>
"Y" AND z$(1 TO 1)<>"y" THEN  IN
K 2
 630 LET x$=STR$ INT (.5+n(k,t))
: PRINT AT 11,(23-LEN x$+1);x$:
IF z$(1 TO 1)<>"y" AND z$(1 TO 1
)<>"Y" THEN  INK 0
 635 INVERSE 1: PRINT AT 13,2;"L
ess": INVERSE 0: PRINT AT 15,2;"
Dividends paid": LET x$=STR$ INT
 (.5+d(k,t)): PRINT AT 15,(23-LE
N x$+1);x$
 637 LET x$=STR$ (INT (.5+o(k,t)
)+INT (.5+n(k,t))-INT (.5+d(k,t)
)): PRINT AT 16,(29-LEN x$+1);x$
 640 PRINT AT 17,24;"______"
 642 INVERSE 1: PRINT AT 19,2;"M
oney in hand": INVERSE 0: IF e(k
)<0 AND z$(1 TO 1)<>"y" AND z$(1
 TO 1)<>"Y" THEN  INK 2
 645 LET x$=STR$ e(k): PRINT AT
19,(29-LEN x$+1);x$: PRINT AT 20
,24;"______": IF z$(1 TO 1)<>"y"
 AND z$(1 TO 1)<>"Y" THEN  INK 0
: PAUSE 850
 652 IF z$(1 TO 1)="Y" OR z$(1 T
O 1)="y" THEN  COPY
 665 CLS : PRINT AT 0,0;"Firm ";
k;AT 0,25;"Year ";t
 670 INVERSE 1: PRINT AT 3,9;"Ba
lance Sheet": PRINT AT 3,26;"#":
 INVERSE 0
 675 PRINT AT 6,2;"Money in hand
": IF e(k)<0 AND z$(1 TO 1)<>"y"
 AND z$(1 TO 1)<>"Y" THEN  INK 2
 680 PRINT AT 6,(29-LEN x$+1);x$
: IF z$(1 TO 1)<>"Y" AND z$(1 TO
 1)<>"Y" THEN  INK 0
 685 IF t>1 THEN  IF r(k,t-1)*n<
r2 THEN  LET k(k)=0.9*k(k)
 690 PRINT AT 8,2;"Stocks": LET
x$=STR$ (INT k(k)*3): PRINT AT 8
,(29-LEN x$+1);x$: IF t>1 THEN
IF r(k,t-1)*n<r2 THEN  PRINT AT
8,8;" (obsolete)"
 695 IF INT k(k)<0 THEN  PRINT A
T 8,24;"     0  "
 700 PRINT AT 10,2;"Machinery":
LET x$=STR$ INT c(k): PRINT AT 1
0,(29-LEN x$+1);x$
 705 PRINT AT 14,24;"______": PR
INT AT 17,24;"______"
 710 INVERSE 1: PRINT AT 16,2;"N
et assets": INVERSE 0: LET x$=ST
R$ INT u(k,t): PRINT AT 16,(29-L
EN x$+1);x$
 715 LET y(k)=INT (.5+y(k)+d(k,t
)): PRINT AT 20,1;"(Total divide
nds paid: #";y(k);")"
 717 PRINT AT 21,2;"-----"
 720 IF z$(1 TO 1)="Y" OR z$(1 T
O 1)="y" THEN  COPY : LPRINT AT
0,0;" (224 * sp)
     ": INK 0: PRINT AT 10,1;"P
lease collect your results."
 725 PAUSE 1200
 730 CLS : NEXT k
 740 IF t=tt THEN  CLS : BORDER
7: PRINT AT 3,9;"FINAL RESULTS":
 FOR k=1 TO n: PRINT AT 4+2*k,4;
"Firm ";k: PRINT AT 4+2*k,20;u(k
,t): NEXT k: PRINT AT 21,0;"Do y
ou want another game? (y/n)": IN
PUT b$: IF b$(1 TO 1)="y" OR b$(
1 TO 1)="Y" THEN  CLS : GO TO 10
0
 742 IF t=tt THEN  STOP
 745 INVERSE 0: CLS : BORDER 7
 750 LET t=t+1: FLASH 1: PRINT A
T 2,11;"FORECAST": FLASH 0: PRIN
T AT 2,23;"Year ";t
 760 LET g=g+INT (RND*5)-INT (RN
D*4)
 765 IF g<=-10 THEN  LET g=-5
 770 IF g>=10 THEN  LET g=6
 780 IF g>=0 THEN  PRINT AT 4,3;
"Demand expected to rise ";g;"%"
 785 IF g<0 THEN  PRINT AT 4,3;"
Demand expected to fall ";-g;"%"
 790 LET v=v+INT (RND*8)-INT (RN
D*3)
 800 IF v<-3 THEN  LET v=-1
 805 IF v>9 THEN  LET v=5
 815 IF v>=0 THEN  PRINT AT 6,3;
"Costs expected to rise  ";v;"%"
 820 IF v<0 THEN  PRINT AT 6,3;"
Costs expected to fall  ";-v;"%"
 825 LET r=r+INT (RND*3)-INT (RN
D*3): IF r>16 THEN  LET r=12
 830 IF r<6 THEN  LET r=7
 840 PRINT AT 8,3;"Interest Rate
s        ": LET x$=STR$ r: PRIN
T AT 8,(28-LEN x$);x$;"%"
 850 FOR k=1 TO n
 860 LET a(t)=a(t)+i(k,t-1)
 870 NEXT k
 880 LET a(t)=a(t)*(1+g/100)
 890 IF a(t)>1.3*a(t-1) THEN  LE
T a(t)=1.3*a(t-1)
 900 IF a(t)<0.7*a(t-1) THEN  LE
T a(t)=0.7*a(t-1)
 910 PRINT AT 10,2;"Capacity of
equipment indus-": PRINT AT 11,2
;"tries is ";INT a(t);" this yea
r."
 920 LET h20=INT (85+RND*15)/100
: LET h19=INT (100+RND*15)/100
 930 PRINT AT 13,2;"If orders fa
ll below this,the";AT 14,2;"pric
e of renewing equipment";AT 15,2
;"will fall by ";INT (100-h20*10
0);" %"
 940 PRINT AT 17,2;"If orders ri
se above this,the";AT 18,2;"pric
e of renewing equipment";AT 19,2
;"will rise by ";INT (100*h19-10
0);" %"
 950 IF z$(1 TO 1)="Y" OR z$(1 T
```

continued on page 76





continued from page 75

```
O 1)="y" THEN  COPY
 960 IF z$(1 TO 1)<>"Y" AND z$(1
 TO 1)<>"y" THEN  BEEP .25,8: BE
EP .25,7: BEEP .25,6: BEEP .25,5
: BEEP .25,4: BEEP .25,12: BEEP
.25,12: BEEP .25,5: BEEP .25,4:
BEEP .25,12: BEEP .25,12: BEEP .
25,5: BEEP .25,4: BEEP .25,12: B
EEP .25,12
 965 PAUSE 550
 970 LET tn=0: FOR k=1 TO n: LET
 tn=tn+n(k,t-1): NEXT k: IF tn/n
>15521 THEN  GO SUB 4000
 975 LET tn=0: FOR k=1 TO n: LET
 tn=tn+n(k,t-1): NEXT k: IF tn/n
>12674 AND tn/n<=15521 THEN  GO
SUB 4500
 980 IF n=1 AND n(1,t-1)<=11675
AND n(1,t-1)>10046 THEN  GO SUB
5000
 985 IF tt>2 THEN  GO TO 1000
 990 CLS : PRINT AT 5,6;"ATTENTI
ON ALL FIRMS !": PRINT AT 10,0;
  "All decisions of firms shoul
d bein numbers. If letters are u
sed,the request for a decision w
ill begin again. If a firm spend
s orproduces too much or too lit
tle,it will be changed to the ma
xi- mum or minimum ."
 992 PRINT AT 20,2;"(Press any k
ey to continue.)"
 995 PAUSE 450: CLS
 1000 CLS : FOR k=1 TO n
 1010 BRIGHT 1: BORDER k: PAPER 7
: INK 0: BRIGHT 0
 1020 PRINT AT 1,1;"Firm ";k;TAB
24;"Year ";t
 1025 IF u(k,t-1)=0 THEN  LET p(k
,t)=p(k,t-1): PRINT AT 4,2;"Unfo
rtunately this firm is      bank
rupt and will not be        deci
ding anything !": PAUSE 300: CLS
 : GO TO 1090
 1027 IF k=2 AND kk=1 THEN  GO TO
 5200
 1030 PRINT : PRINT "Please decla
re your decisions on": FLASH 1:
PRINT AT 5,0; PAPER 1; INK 7; BR
IGHT 1;"              PRICE
       ": FLASH 0: PRINT AT 14,
0;"Advice": PRINT AT 17,0;" Last
 year your price was ";p(k,t-1);
".": PRINT " Prices averaged aro
und ";INT (p/n);" then.": PRINT
" Your price may vary between 1
 and 99."
 1032 GO SUB 5100
 1033 IF VAL b$<1 OR VAL b$>99 TH
EN  GO TO 1032
 1034 LET p(k,t)=VAL b$: IF x45=1
 AND p(k,t)>p(k,t-1) THEN  LET p
(k,t)=p(k,t-1): LET x45=0
 1035 PRINT AT 21,0;"          ": LE
T p(k,t)=INT (p(k,t)*100)/100: I
F p(k,t)<1 THEN  LET p(k,t)=1
 1037 IF p(k,t)>99 THEN  LET p(k,
t)=99
 1040 PRINT AT 5,0; PAPER 2; INK
7; FLASH 1; BRIGHT 1;"
 PRODUCTION              ": PRINT A
T 17,0;     " You may make up to
 ";INT (c(k)/20);" this   year,
or ";INT (c(k)*.075+.5);" with o
vertime.
                               "
 1042 GO SUB 5100
 1043 IF VAL b$>INT (c(k)*.075+.5
) THEN  GO TO 1042
 1045 LET q(k,t)=VAL b$: LET q(k,
t)=INT q(k,t): IF q(k,t)>1.5*c(k
) THEN  LET q(k,t)=1.5*c(k)
 1047 PRINT AT 21,0;"          ": IF
 q(k,t)<0 THEN  LET q(k,t)=0
 1050 FLASH 1: PRINT AT 5,0; PAPE
R 0; INK 6; BRIGHT 1;"
MARKETING                ": FLASH 0
: PRINT AT 17,0; " You may spend
 up to #100000 on  marketing. La
st year you spent  #";m(k,t-1);"
.                              "
 1052 GO SUB 5100
 1053 IF VAL b$>100000 THEN  GO T
O 1052
 1055 LET m(k,t)=VAL b$: LET m(k,
t)=INT m(k,t): IF m(k,t)>100000
THEN  LET m(k,t)=100000
 1057 PRINT AT 21,0;"          ": I
F m(k,t)<0 THEN  LET m(k,t)=0
 1060 PRINT AT 5,0; FLASH 1; PAPE
R 4; INK 0;"      RESEARCH & DEVE
LOPMENT      ": PRINT AT 16,0;  "
Research and development lowers
costs and raises the appeal of
the product. You may spend up to
#100000. Last year   you spent
#";r(k,t-1);".      "
 1062 GO SUB 5100
 1063 IF VAL b$>100000 THEN  GO T
O 1062
 1065 LET r(k,t)=VAL b$: LET r(k,
t)=INT r(k,t): IF r(k,t)>100000
THEN  LET r(k,t)=100000
 1067 PRINT AT 21,0;"          ":
IF r(k,t)<0 THEN  LET r(k,t)=0
 1070 PRINT AT 5,0; FLASH 1; PAPE
R 5; INK 0; BRIGHT 1;"
 NEW EQUIPMENT           ": FLASH 0
: PRINT AT 15,0;"Each #20 spent
on Repairs and   Renewals will e
nable you to     produce an extr
a unit of output next year. You
may spend up to  #100000.  Last
 year   you spent #";INT (i(k,t-1
)+.5)
 1072 GO SUB 5100
 1073 IF VAL b$>100000 THEN  GO T
O 1072
 1075 LET i(k,t)=VAL b$: LET i(k,
t)=INT i(k,t): IF i(k,t)>100000
THEN  LET i(k,t)=100000
 1077 PRINT AT 21,0;"          ": IF
 i(k,t)<0 THEN  LET i(k,t)=0
 1080 PRINT AT 5,0; FLASH 1; PAPE
R 7; INK 1; BRIGHT 1;"
  DIVIDENDS              ": FLASH 0
: PRINT AT 17,0;    "By paying di
vidends to sharehol-ders, you ma
ke your company's    shares more
valuable. Last year you paid out
 ";d(k,t-1);".
                               "
 1085 GO SUB 5100: LET d(k,t)=VAL
 b$: LET d(k,t)=INT d(k,t): IF d
(k,t)>100000 THEN  LET d(k,t)=10
0000
 1087 IF d(k,t)<0 THEN  LET d(k,t
)=0
 1090 CLS : NEXT k
 1100 LET st=RND: IF st>.1 THEN
GO TO 1200
 1105 BORDER 2: FLASH 1: PRINT AT
 5,12;"STRIKE": FLASH 0: PAUSE 2
00: CLS
 1110 FOR k=1 TO n
 1115 IF u(k,t-1)=0 THEN  GO TO 1
195
 1117 PRINT AT 1,1;"Firm ";k
 1120 IF k=1 AND z$(1 TO 1)="y" O
R z$(1 TO 1)="Y" THEN  LPRINT  "
Your workers threaten to strike.
Each firm must choose whether to
give in to their demands, which
would raise costs by about 20%
or suffer a considerable loss of
output - perhaps a quarter.

Firms may consult each other but
must decide in secret. Do you
concede ?  (y/n)"
 1125 PRINT AT 5,0; "Your workers
 threaten to strike.Each firm mu
st choose whether togive in to t
heir demands, which would raise
costs by about 20%  or suffer a
considerable loss ofoutput - per
haps a quarter.
                  Firms may co
nsult each other butmust decide
in secret. Do you    concede ?  (
y/n)"
 1140 IF k=2 AND kk=1 THEN  IF RN
D>.5 THEN  LET c$="y": GO TO 117
0
 1145 IF k=2 AND kk=1 THEN  IF RN
D>.5 THEN  LET c$="n": GO TO 118
0
 1150 IF INKEY$<>"" THEN  GO TO 1
150
 1160 LET c$=INKEY$: IF c$="" THE
N  GO TO 1160
 1165 IF c$(1 TO 1)="y" THEN  PRI
NT AT 20,10; FLASH 1; PAPER 2; I
NK 7;"WE CONCEDE !": PAUSE 200
 1170 IF c$(1 TO 1)="y" THEN  LET
 v(k,t-1)=(1.15+RND/10)*v(k,t-1)
: LET v(k,t)=(1.15+RND/10)*v(k,t
)
 1180 IF c$<>"y" THEN  LET q(k,t)
=INT (q(k,t)*(0.7+RND/10))
 1190 IF z$(1 TO 1)<>"Y" AND z$(1
 TO 1)<>"y" THEN  PAUSE 200
 1195 NEXT k
 1200 CLS : BORDER 7: LET q=0: LE
T p=0: LET pp=0: LET m=0: LET mm
=0: LET r1=0: LET r2=0
 1205 PRINT AT 14,8;"(5*isp,6*sp,
5*isp)"
 1206 PRINT AT 13,8;"(5*isp,6*sp,
5*isp)"
 1210 FOR k=1 TO n
 1220 LET q=q+s(k,t-1): LET p=p+p
(k,t)
 1230 LET pp=pp+p(k,t-1)*s(k,t-1)
 1240 LET m=m+m(k,t)
 1250 LET mm=mm+m(k,t-1)
 1260 LET r1=r1+r(k,t)
 1265 LET r2=r2+r(k,t-1)
 1270 NEXT k
 1275 PRINT AT 12,8;"CCC(2*ig5,6*
sp)CCC(2*g5)"
 1280 LET pp=pp/q
 1285 PRINT AT 11,11;"(2*ig5,9*sp
,2*g5)"
 1290 LET q=q*(1+g/100)*h1: LET h
1=1
 1295 LET x=0: PRINT AT 14,x;"(sp
,ig7,ig3,g4)": PRINT AT 13,x;"(3
*sp,g7)": INK 4: PRINT AT 13,x;"
(sp,2*g3)": INK 0: LET x=x+1
 1297 PAUSE 20
 1300 IF m>mm THEN  LET q=q*1.02:
 IF m>mm*1.2 THEN  LET q=q*(1+RN
D/10)
 1305 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 4: PRINT AT 13,x;"(sp,2*g3)
": INK 0: LET x=x+1
 1307 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 4: PRINT AT 13,x;"(sp,2*g3)
": INK 0: LET x=x+1
 1310 IF a(t)<a(t-1) THEN  LET q=
q*0.99
 1315 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 4: PRINT AT 13,x;"(sp,2*g3)
": INK 0: LET x=x+1
 1320 IF a(t)>a(t-1) THEN  LET q=
```

```
q*1.02
1325 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 4: PRINT AT 13,x;"(sp,3*g3)
": INK 0: LET x=x+1
1330 IF m<mm THEN  LET q=q*0.99
1335 PRINT AT 14,x;"(sp,ig7,ig3)
": PRINT AT 13,x;"    ": INK 4:
 PRINT AT 13,x;"(sp,2*g2)": INK
0: LET x=x+1
1345 PAUSE 10: PRINT AT 14,x;"
 ": PRINT AT 13,x;"  ": INK 4
: PRINT AT 13,x;" ": INK 0: LET
 x=x+1: PAUSE 10
1350 LET x=0
1354 PRINT AT 10,11;"(2*g1)": PR
INT AT 10,22;"(2*g1)": PAUSE 10:
1364 PRINT AT 10,11;"  ": PRIN
T AT 10,22;"  ": PAUSE 10:
1400 FOR k=1 TO n
1410 LET p1=(.1+pp)/(p(k,t-1)*n+
.1)*0.2+(.1+.4*p(k,t-1))/(.1+p(k
,t))+(.1+0.4*p)/(.1+(p(k,t)*n))
1430 LET m2=(mm+.1)/(m(k,t-1)*n+
.1)*0.15+(0.3*m(k,t-1)+.1)/(m(k,
t)+0.1)+(0.55*m+.1)/(m(k,t)*n+.1
)
1450 LET r3=(r2+1)/(r(k,t-1)*n+1
)*0.4+(0.1*r(k,t-1)+1)/(r(k,t)+1
)+(0.5*r1+1)/(r(k,t)*n+1)
1455 IF p(k,t)>1.26*p(k,t-1) THE
N  LET p1=0.5*p1: IF p(k,t)>3*p(
k,t-1) THEN  LET p1=0.2*p1: LET
m2=10*m2
1460 LET z(k,t)=p1*f3+f2/m2+f1/r
3
1461 IF r(k,t-1)>1.5*r2/n THEN
LET z(k,t)=2*z(k,t)
1462 IF u(k,t-1)=0 THEN  LET z(k
,t)=0: LET u(k,t)=0
1463 IF p(k,t)>1.15*p/n THEN  LE
T z(k,t)=0.75*z(k,t): IF p(k,t)>
1.55*p/n THEN  LET z(k,t)=0.25*z
(k,t)
1464 IF p(k,t)<.89*p/n THEN  LET
 z(k,t)=1.5*z(k,t)
1465 IF p(k,t)>p(k,t-1)*1.21 THE
N  LET z(k,t)=0.75*z(k,t)
1470 NEXT k
1471 PRINT AT 10,11;"(2*g1)": PR
INT AT 10,22;"(2*g1)": PAUSE 10:
1475 LET z=0
1480 FOR k=1 TO n: LET z=z+z(k,t
): NEXT k
1488 PRINT AT 10,11;"  ": PRIN
T AT 10,22;"  ": PAUSE 10:
1500 FOR k=1 TO n
1510 LET s(k,t)=q*z(k,t)/z
1520 IF s(k,t)>q(k,t)+k(k) THEN
 LET s(k,t)=q(k,t)+k(k)
1530 IF s(k,t)>s(k,t-1)*3.65 THE
N  LET s(k,t)=s(k,t-1)*3.65
1540 LET k(k)=q(k,t)-s(k,t)+k(k)
1545 LET f(k,t)=f(k,t-1)*(1+v/10
0): LET v(k,t)=v(k,t-1)*(1+v/100
)
1550 LET h(k,t)=f(k,t)+q(k,t)*v(
k,t): IF q(k,t)>c(k)/20 THEN  LE
T h(k,t)=h(k,t)+(q(k,t)-c(k)/20)
*v(k,t)/3+f(k,t)/15
1555 LET b(k,t)=b(k,t-1): IF q(k
,t)>c(k)/20 THEN  LET b(k,t)=b(k
,t)*1.2
1560 NEXT k
1564 PRINT AT 10,11;"(2*g1)": PR
INT AT 10,22;"(2*g1)": PAUSE 10:
1566 PRINT AT 10,11;"  ": PRIN
T AT 10,22;"  ": PAUSE 10:
1570 LET i=0
1580 FOR k=1 TO n: LET i=i+i(k,t
): NEXT k
1590 IF i>=a(t) THEN  GO TO 1650
1600 FOR k=1 TO n
1610 LET c(k)=c(k)+i(k,t)
1620 LET i(k,t)=INT (h20*i(k,t)+
.5)
1630 NEXT k: GO TO 1700
1650 IF i>a(t) THEN  GO TO 1670
1660 FOR k=1 TO n: LET c(k)=c(k)
+i(k,t)
1665 GO TO 1700
1670 LET f4=i/a(t): FOR k=1 TO n
1672 IF i(k,t)<=i/n THEN  LET c(
k)=c(k)+INT (i(k,t)/f4): LET i(k
,t)=i(k,t)/f4*h19
1675 IF i(k,t)>i/n THEN  LET c(k
)=c(k)+i(k,t): LET i(k,t)=i(k,t)
*h19
1678 NEXT k
1680 BORDER 2: INK 1: PAPER 5: F
LASH 1: PRINT AT 2,10;"Newsflash
!": FLASH 0: PRINT AT 6,0;"  Cap
ital industries working
      overtime.           "
1690 PAUSE 120: BORDER 7: PAPER
7: CLS : INK 0
1695 IF z$(1 TO 1)="Y" OR z$(1 T
O 1)="y" THEN  LPRINT "
   Newsflash!           Capita
l industries working
    overtime"
1800 FOR k=1 TO n
1810 LET g(k,t)=INT (s(k,t)*p(k,
t)-h(k,t)-r(k,t)-i(k,t)-m(k,t)+0
.5)
1820 IF i(k,t)>i/n THEN  LET b(k
,t)=.95*b(k,t)
1830 IF i(k,t)<i/n THEN  LET b(k
,t)=1.05*b(k,t)
1840 IF r(k,t)*n>r1 THEN  LET b(
k,t)=.97*b(k,t)
1850 IF r(k,t-1)*n>r2 THEN  LET
b(k,t)=.985*b(k,t)
1860 IF r(k,t)<r1/n THEN  LET b(
k,t)=1.02*b(k,t)
1870 LET o(k,t)=INT (c(k)*b(k,t)
+0.5)
1875 LET c(k)=INT (c(k)-o(k,t))
1880 IF e(k)<0 THEN  LET w(k,t)=
INT (0.5+e(k)*-r/100)
1890 IF e(k)>5000 THEN  LET w(k,
t)=(4-r)/100*(e(k)-5000)
1900 LET tx=tr*(g(k,t)-o(k,t)-w(
k,t))
1910 IF tx>0 THEN  LET t(k)=tx
1920 IF tx<t(k) AND t(k)<=0 THEN
  LET t(k)=0
1930 IF tx<0 AND t(k)>0 THEN  IF
 t(k)<-tx THEN  LET t(k)=-t(k)
1940 IF tx<0 AND t(k)>0 THEN  IF
 t(k)>-tx THEN  LET t(k)=tx/tr
1950 LET n(k,t)=INT (g(k,t)-o(k,
t)-w(k,t)-t(k)+0.5)
1960 LET e(k)=INT (0.5+e(k)+n(k,
t)+o(k,t)-d(k,t))
1975 LET u(k,t)=e(k)+INT k(k)*3+
c(k)
2005 IF u(k,t)>960000 THEN  GO T
O 2130
2015 IF u(k,t)<0 THEN  LET u(k,t
)=0
2020 NEXT k: IF i>a(t) THEN  GO
TO 2038
2022 PRINT AT 14,8;"(5*g8,6*sp,5
*g8)"
2024 PRINT AT 13,8;"(5*g8,6*sp,5
*g8)"
2026 PRINT AT 12,8;"CCC(2*ig5,6*
sp)CCC(2*ig5)"
2028 PRINT AT 11,11;"(2*ig5,9*sp
,2*ig5)"
2030 PRINT AT 10,11;"(2*ig1)": P
RINT AT 10,22;"(2*ig1)": PAUSE 1
0:
2032 PAUSE 5: PRINT AT 10,11;"
 ": PRINT AT 10,22;"  ": PAUS
E 10: LET x=25
2033 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 6: PRINT AT 13,x;"(sp,2*g3)
": INK 0: LET x=x+1
2034 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 6: PRINT AT 13,x;"(sp,2*g3)
": INK 0: LET x=x+1
2035 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 6: PRINT AT 13,x;"(sp,2*g3)
": INK 0: LET x=x+1
2037 PRINT AT 14,x;"(sp,ig7,ig3,
g4)": PRINT AT 13,x;"(3*sp,g7)":
 INK 6: PRINT AT 13,x;"(sp,2*g3)
": INK 0: PAUSE 50: CLS
2038 LET yyy=1: PLOT 0,10: DRAW
255,0: PLOT 50,0: DRAW 0,175
2040 FOR k=1 TO n: IF u(k,t)>500
000 THEN  LET yyy=0.5
2050 NEXT k
2060 PRINT AT 0,8;"Asset Values
- Year ";t
2070 PRINT AT 1,0;"1000s"
2080 PRINT AT 21,27;"Firm"
2090 IF yyy=1 THEN  PRINT AT 10,
1;"250"
2095 IF yyy=0.5 THEN  PRINT AT 1
5,1;"250"
2100 FOR k=1 TO n
2105 IF u(k,t)>960000 THEN  GO T
O 2130
2110 INK k: FOR y=1 TO 24: PLOT
55+y+(24*(k-1)),10: DRAW 0,u(k,t
)*0.00033*yyy: NEXT y
2115 IF n=1 THEN  INK 2: FOR y=1
 TO 24: PLOT 55+y+24,10: DRAW 0,
u(k,t-1)*0.00033: NEXT y: INK 0:
 PRINT AT 21,10;"(Year ";t-1;")"
2120 INK 0: PRINT AT 21,5+(k*3);
k
2130 NEXT k
2138 BEEP .15,4: BEEP .15,6: BEE
P .15,7: BEEP .15,4: BEEP .15,6:
 BEEP .5,7: PAUSE 15
2140 BEEP .15,6: BEEP .15,4: BEE
P .15,6: BEEP .5,7: PAUSE 15
2142 BEEP .15,6: BEEP .15,4: BEE
P .15,7: BEEP .5,7: BEEP .3,4
2144 BEEP .15,12: BEEP .15,11: B
EEP .15,12: BEEP .15,11: BEEP .1
5,4: BEEP .6,9: PAUSE 15
2146 BEEP .3,7: BEEP .3,6: BEEP
.15,4: BEEP .15,6: BEEP .15,7: B
EEP .15,4: BEEP .15,6: BEEP .5,7
: PAUSE 15: BEEP .15,6: BEEP .15
,4: BEEP .15,7: BEEP .5,7: BEEP
.6,4
2148 PAUSE 200: CLS
2150 LET to=0
2160 LET an=0
2170 FOR k=1 TO n: LET to=to+s(k
,t): NEXT k
2180 FOR k=1 TO n
2190 LET an=an+s(k,t)/to*2*PI
2195 IF s(k,t)=0 THEN  NEXT k
2197 IF u(k,t)=0 THEN  NEXT k
2200 PLOT 127,86: DRAW 80*COS an
,80*SIN an
2202 IF COS an>=0 AND SIN an<=0.
5 AND SIN an>0 THEN  LET an1=2:
LET an2=-1
2203 IF COS an>=0 AND SIN an>0.5
 THEN  LET an1=2: LET an2=2
2204 IF COS an<0 AND SIN an>0.5
THEN  LET an1=-1: LET an2=2
2205 IF COS an<0 AND SIN an<=0.5
 AND SIN an>0 THEN  LET an1=-1:
LET an2=2
2206 IF COS an<=0 AND SIN an<=0
AND SIN an>=-0.5 THEN  LET an1=-
2: LET an2=1
```

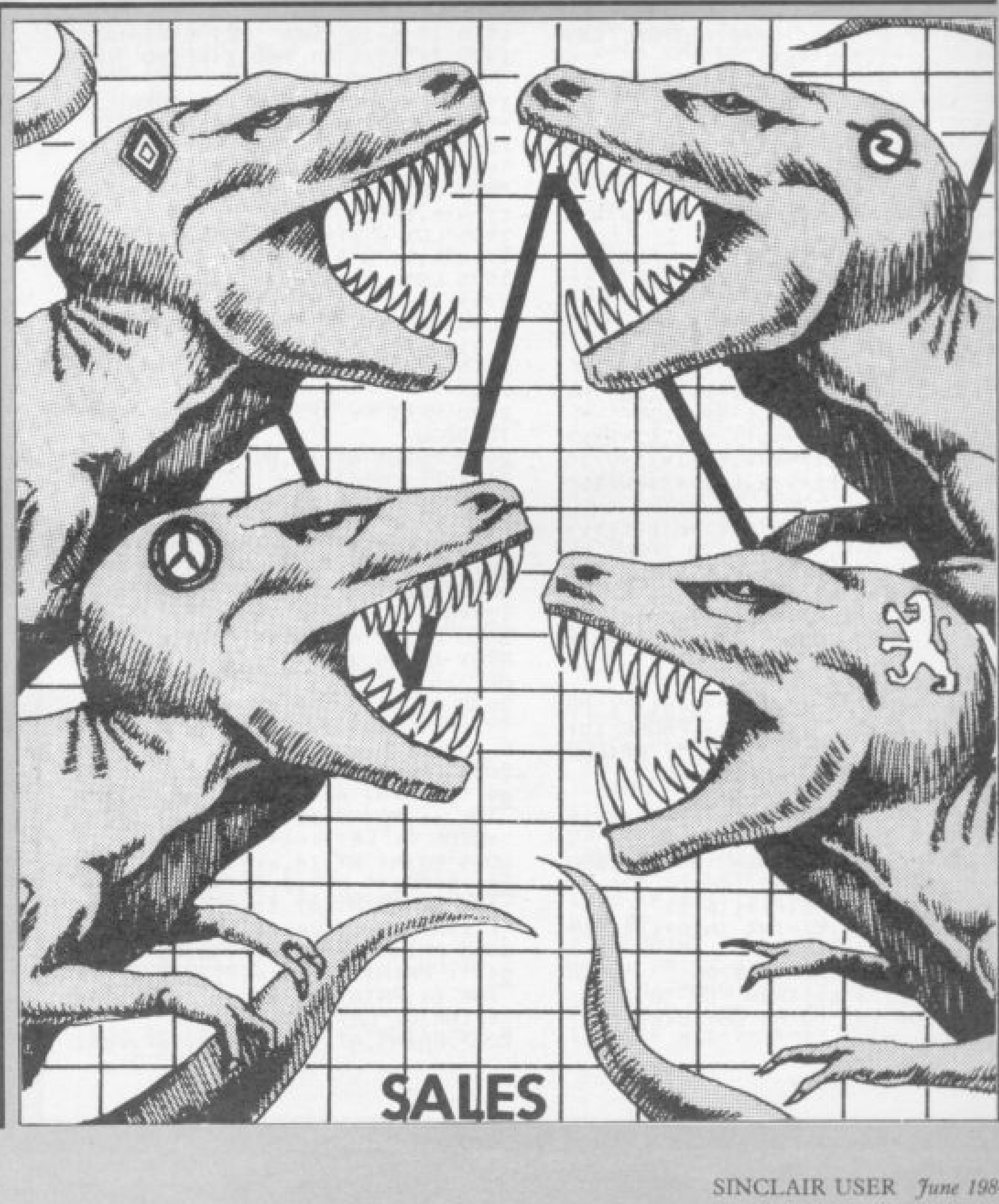
continued on page 78



continued from page 77

```
2207 IF COS an<=0 AND SIN an<-0.
5 THEN  LET an1=-2: LET an2=-2
2208 IF COS an>0 AND SIN an<-0.5
 THEN  LET an1=-1: LET an2=-2
2209 IF COS an>0 AND SIN an>=-0.
5 AND SIN an<=0 THEN  LET an1=2:
 LET an2=-2
2210 IF INT (21-(86+80*SIN an)/8
+an1)<1 THEN  LET an1=2
2212 IF INT (21-(86+80*SIN an)/8
+an1)>=20 THEN  LET an1=-3
2220 PRINT AT INT (21-(82+80*SIN
 an)/8+an1),INT ((131+80*COS an)
/8)+an2;k
2245 NEXT k
2250 CIRCLE 127,86,80
2255 PRINT AT 0,6;"Sales Units -
 Year ";t
2260 PAUSE 450: CLS
3000 GO TO 500
4000 CLS : PRINT AT 2,11;"IMPORT
S !"
4005 LET h1=1-RND/10
4007 IF z$="y" THEN  LPRINT "   H
igh profits in the industry    h
ave attracted foreign comp-    e
tition,which is expected to    t
ake ";INT ((1-h1)*100);"% of the
 market. (91 * sp)
   "
4010 PRINT AT 5,0;"   High profit
s in the industry    have attrac
ted foreign comp-    etition,whi
ch is expected to    take ";INT
((1-h1)*100);"% of the market."
4020 PRINT AT 18,0;"(5*g8)": PRI
NT AT 19,0;"(5*g8)": INK 5: PRIN
T AT 19,5;"(27*g8)"
4030 INK 1: LET x=15
4040 PRINT AT 18,x;"A(4*g8,g1,g3
)B "
4050 PRINT AT 17,x;"(3*sp,ig4,g2
,2*sp)"
4055 INK 6: PRINT AT 17,x+1;"
 ": INK 1
4060 PAUSE 10: LET x=x-1
4070 IF x>4 THEN  GO TO 4040
4075 BEEP 1.5,-30: PRINT AT 17,x
+1;"  ": PAUSE 20: INK 6: PRIN
T AT 17,1;"(3*g8)": PRINT AT 16,
2;"(g8,g3)": INK 0: PAUSE 95
4080 RETURN
4500 CLS : PRINT AT 6,11;"TAXES
UP !"
4510 LET tr=tr+0.05
4520 PRINT AT 8,0;              "
The Government announces that
everyone is spending too much.
It is therefore raising taxes
by five percentage points to
";tr*100;"% ."
4525 LPRINT "The Government anno
unces that   everyone is spendin
g too much.  It is therefore rai
sing taxes   by five percentage
points to     ";tr*100;"% .

                "
4530 IF tr>.45 THEN  PRINT AT 12
,4;"again ."
4540 FOR x=1 TO 32: PRINT AT 0,x
-1;"#": PAUSE 2: NEXT x: FOR x=1
 TO 21: PRINT AT x-1,31;" ": PR
INT AT x,31;"#": BEEP .1,10-x: N
EXT x
4550 RETURN
5000 CLS : PRINT AT 5,0;        "
Profits in the industry have
caused concern and you have
been referred to the Monopolies
Commission. You may not raise
your price next year."
5010 LPRINT "Profits in the indu
stry have    caused concern and
you have     been referred to th
e Monopolies Commission. You may
 not raise   your price next yea
r."
5020 PAUSE 550: LET x45=1
5030 RETURN
5100 LET b$=""
5105 IF INKEY$<>"" THEN  GO TO 5
105
5110 LET a$=INKEY$: IF a$="" THE
N  GO TO 5110
5115 IF CODE a$=13 AND b$<>"" TH
EN  RETURN
5120 IF CODE a$>57 OR CODE a$<48
 AND CODE a$<>46 THEN  BEEP 1,10
: PRINT AT 21,0;"           ": GO
 TO 5100
5125 LET b$=b$+a$: BEEP .01,.01:
 PRINT AT 21,LEN b$;"*"
5130 GO TO 5105
5202 LET p(k,t)=p(k,t-1)
5204 LET dif=p(k,t)-p(1,t-1)
5206 LET p(k,t)=p(k,t)-dif*RND
5208 LET p(k,t)=INT (p(k,t)*(1+R
ND/5-RND/5)): IF e(k)<0 AND RND>
.3 THEN  LET p(k,t)=p(k,t)+1
5210 LET q(k,t)=INT (c(k)/20)
5215 IF k(k)>0 AND p(k,t)>=p(k,t
-1) THEN  LET q(k,t)=q(k,t)-INT
(k(k)*RND*1.25)
5220 IF k(k)<c(k)/100 AND RND>.9
 THEN  LET q(k,t)=INT (c(k)*1.5/
20)
5222 IF p(k,t)<5 THEN  LET p(k,t
)=5+INT (RND*5)
5224 IF p(k,t)>80 THEN  LET p(k,
t)=p(k,t)-INT (RND*25)
5230 LET m(k,t)=m(k,t-1)
5235 IF m(1,t-1)>m(k,t) THEN  LE
T m(k,t)=m(k,t)*(1+RND/2)
5240 IF m(k,t)>1.8*m(1,t-1) THEN
  LET m(k,t)=m(1,t-1)*(1+RND)
5245 IF m(k,t)<2000 THEN  LET m(
k,t)=3000+INT (RND*3000)
5248 LET m(k,t)=INT m(k,t)
5250 IF m(k,t)>100000 THEN  LET
m(k,t)=INT (m(k,t)-RND*20000)
5255 LET r(k,t)=r(k,t-1)
5260 LET r(k,t)=INT (r(k,t)*(1+R
ND+RND-RND))
5265 IF r(k,t)<1000 THEN  LET r(
k,t)=1000+INT (RND*2500)
5267 IF r(k,t)>r(1,t)*2 THEN  LE
T r(k,t)=INT (r(k,t)/(1+RND)): I
F r(k,t)>100000 THEN  LET r(k,t)
=INT (r(k,t)-(RND*40000))
5270 IF s(k,t-1)>=.95*q(k,t-1) T
HEN  LET i(k,t)=c(k)/20*(1+RND*1
.5-RND)
5272 IF s(k,t-1)<.95*q(k,t-1) TH
EN  LET i(k,t)=c(k)/20*(1-RND*1.
5+RND)
5275 IF s(k,t-1)<.55*q(k,t-1) TH
EN  LET i(k,t)=c(k)/40*(1-RND*.1
+RND*.1)
5280 LET i(k,t)=INT i(k,t): IF i
(k,t)<1000 THEN  LET i(k,t)=INT
(1000+1000*RND)
5285 IF i(k,t)>15000 THEN  LET i
(k,t)=INT (20000-RND*10000)
5290 IF e(k)<-3000 THEN  IF m(k,
t)>11000 THEN  LET m(k,t)=m(k,t)
-1580
5295 IF e(k)<-3000 THEN  IF r(k,
t)>8000 THEN  LET r(k,t)=r(k,t)-
1870
5300 IF e(k)<-2000 THEN  IF i(k,
t)>6000 THEN  LET i(k,t)=i(k,t)-
2340
5400 GO TO 1090
9940 BORDER 0: PAPER 0: INK 7: C
LS
9942 PRINT AT 0,11; PAPER 2; INK
 7; BRIGHT 1;"OLIGOPOLY"
9948 PRINT AT 5,7; BRIGHT 1; 1
983 N.Holgate."
9970 RETURN
```





SPARX

YOUR SPECTRUM processor is being attacked by the **Sparx** and you have to electrify the wires to give them a deadly electric shock. Extra points are gained for each phase completed and the game ends when a Sparx reaches the chip.

Sparx was written for the 16K Spectrum by Jonathan Currey, London SE12.

```
   5 LET hs=0
  10 INK 6: PAPER 0: BORDER 0: C
LS
  15 GO TO 1000
  20 RESTORE 21: FOR i= USR "a"
TO  USR "c"+7: READ j: POKE i,j:
 NEXT i
  21 DATA 0,0,0,255,255,0,0,0,6,
30,126,254,126,30,6,0,153,90,24,
255,255,24,90,153
  23 IF  INKEY$  <> "" THEN  GO
TO 22
  24 FOR i=1 TO 6: PRINT  INK i;
 AT 21,5;"Press Any Key To Play"

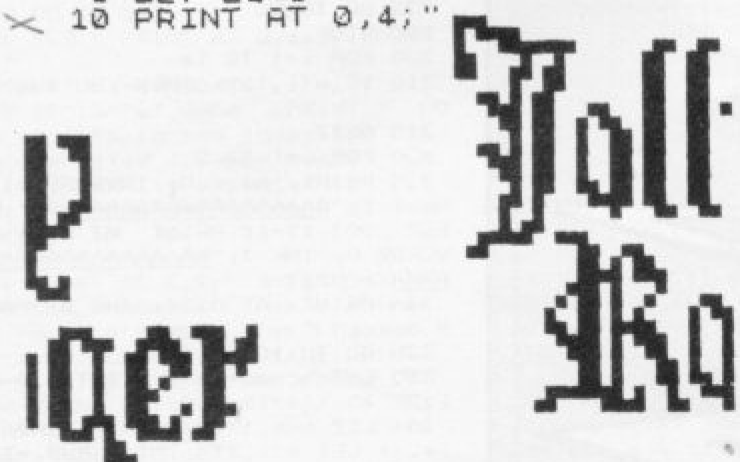
  25 FOR j=1 TO 20: IF  INKEY$
<> "" THEN  CLS : GO TO 30
  26 NEXT j
  27 NEXT i: GO TO 24
  30 LET sc=0: LET max=100: LET
x=4
  34 LET lev=3
  35 DIM e(lev,2)
  37 FOR i=1 TO lev
  38 LET e(i,1)=4+( INT ( RND *8
)*2): LET e(i,2)= INT ( RND *3)+
1
  39 NEXT i
  40 PRINT  AT 0,0; PAPER 5;"
                                "

  41 PRINT  AT 0,0; INK 0; PAPER
 5;"Time:";max; AT 0,18;"Score:"
;sc: PRINT  AT 21,0; BRIGHT 1;"H
igh-score:";hs
  50 FOR i=2 TO 20: PRINT  PAPER
 lev; BRIGHT 1; AT i,20;"
 ": NEXT i
  51 FOR i=4 TO 18 STEP 2: PRINT
  INK 7; AT i,0;"AAAAAAAAAAAAAAA
AAAAA": NEXT i
  52 INK 7: PAPER lev: BRIGHT 1:
 PRINT  AT 5,24;"Z"; AT 9,24;"8"
; AT 13,24;"0"; AT 17,24;"A": IN
K 6: PAPER 0: BRIGHT 0
  60 FOR t=max TO 0 STEP -1
  65 BEEP .01,-20
  70 PRINT  AT x,20; BRIGHT 1; P
APER lev;" "
  71 PRINT  PAPER 5; INK 0; AT 0
,5;t;" "
  75 IF  IN 64510 <> 255 AND  IN
 64510 <> 191 THEN  IF x>4 THEN
 LET x=x-2
  80 IF  IN 65022 <> 255 AND  IN
 65022 <> 191 THEN  IF x<18 THEN
  LET x=x+2
  85 PRINT  AT x,20; BRIGHT 1; P
APER lev; INK 7;"B"
  86 IF  INKEY$ ="h" THEN  GO TO
 230
  90 IF  IN 32766 <> 255 AND  IN
 32766 <> 191 THEN  GO TO 300
 105 FOR i=1 TO lev: LET e(i,2)=
e(i,2)+1
 110 PRINT  AT e(i,1),e(i,2)-1;
INK 7;"A"; BRIGHT 1; INK 6;"C"

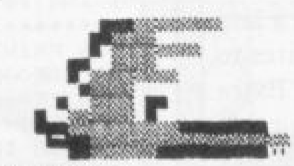
 111 IF e(i,2)=20 THEN  GO TO 50
0
 112 NEXT i
 200 NEXT t
 201 FOR j=1 TO 5: FOR i=7 TO 0
STEP -1: BORDER i: PRINT  AT 1,8
; INK i;"PHASE COMPLETED": BEEP
.01,20-i: NEXT i: NEXT j
 210 LET lev=lev-1: IF lev=0 THE
N  LET lev=3: LET max=max+50: IF
 max>500 THEN  LET max=100
 220 GO TO 35
 230 IF  INKEY$  <> "" THEN  GO
TO 230
 231 IF  INKEY$ ="" THEN  GO TO
231
 232 GO TO 90
 250 STOP
 300 FOR i=1 TO lev
 310 IF e(i,1)=x THEN  GO SUB 35
0
 315 NEXT i
 320 FOR i=1 TO 5
 325 PRINT  AT x,0; INVERSE 1; I
NK 1+i;"AAAAAAAAAAAAAAAAAAAA": B
EEP .003,17+i: PRINT  AT x,0; IN
VERSE 0; INK 7;"AAAAAAAAAAAAAAAA
AAAA": NEXT i
 326 PRINT  AT 0,24; INK 0; PAPE
R 5;sc;" "
 330 GO TO 100
 350 LET sc=sc+ INT ( INT (20-e(
i,2))*5)*(4-lev)
 351 LET e(i,1)=4+( INT ( RND *8
)*2): LET e(i,2)= INT ( RND *3)+
1: RETURN
 500 FOR i=7 TO 0 STEP -1: BORDE
R i: BEEP .01,i: NEXT i
 510 FOR i=1 TO 250: NEXT i
 515 FOR i=1 TO 20: PRINT  AT i,
0; INK lev+3;"******************
***************": NEXT i
 516 PRINT  AT 10,8; INVERSE 1;"
G A M E  O V E R"
 520 IF sc>hs THEN  PRINT  AT 0,
24; FLASH 1;sc: PRINT  AT 15,8;
INVERSE 1; FLASH 1;"A New High-S
core": LET hs=sc
 530 PRINT  AT 20,0; PAPER 1; IN
K 7;"- Press Any Key To Play Aga
in. -": IF  INKEY$  <> "" THEN
GO TO 530
 540 IF  INKEY$ ="" THEN  GO TO
540
 550 CLS : GO TO 30
1000 CLS : PRINT  AT 0,13; INK 7
; BRIGHT 1;"SPARX!"
1010 PRINT  AT 3,3;"The evil Spa
rx are attacking"
1011 PRINT "your Spectrum's Z80
processor"
1012 PRINT "along its incoming w
ires."
1013 INK 5: PRINT "    Your only
 defence is the"
1014 PRINT "ability to electrify
 the wires"
1015 PRINT "which kills the Spar
x on them."
1016 INK 3: PRINT "    If a Spar
x reaches the chip"
1017 PRINT "you have lost."
1018 PRINT : INK 4
1019 PRINT "You:"; INK 7;".....
B"
1020 PRINT "Sparx:"; INK 7;"....
C"
1021 PRINT "Wire:"; INK 7;".....
A"
1024 PRINT : INK 5
1025 PRINT "KEYS:": INK 7
1026 PRINT "    Q=Move Up."
1027 PRINT "    A=Move Down."
1028 PRINT "    B=Electrify Wire
."
1029 INK 6: GO TO 20
8999 STOP
9000 SAVE "SPARX" LINE 5: VERIFY
 "SPARX": RUN
```

JOLLY

```
   1 REM "ROGER"
   5 LET TR=1000
   6 LET TI=100
   7 LET CR=10
   8 LET LI=3
x 10 PRINT AT 0,4;"
```



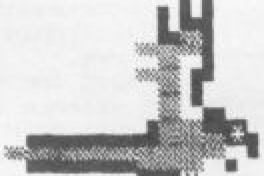
```
"
  11 PRINT AT 20,5;"WHAT MIGHT Y
OUR NAME BE?"
  12 INPUT N$
  15 CLS
x 16 LET S$="
```



```
x17 LET P$="
```



```
"
x18 LET O$="
```



```
  20 PRINT P$
  22 PRINT AT 5,10;"WELCOME ABOA
RD,";AT 6,10;"CAP""N ";N$
  23 FOR X=1 TO 50
  24 NEXT X
  25 PRINT AT 21,3;"▬"
  26 FOR X=1 TO 50
  27 NEXT X
  28 PRINT AT 13,0;"IF I SIGHT A
 SHIP,YOU CAN EITHERSAIL ON(S)OR
 ATTACK IT(A)WITH     YOUR CANNON
                      IF YOU LOSE,
YOU LOSE ALL YOUR     TREASURE,AND
 VERY LIKELY A LEG    OR SOMETHING
..."
  29 PRINT AT 21,8;"PRESS A KEY.
.."
  30 IF INKEY$="" THEN GOTO 30
  32 PRINT AT 13,0;"IF YOU SAIL
TO TREASURE ISLAND    YOU CAN BURY
 YOUR BOOTY THERE,    AND IT WILL
```

YOU ARE captain of a pirate ship and you have to sail to the treasure island to bury your booty. At the start of the voyage you have 1,000 doubloons and 10 cut-throats as crew. Extra crew members can be



ROGER

gained when you attack other ships but you can also have a run of bad luck and lose your treasure — or an eye or a leg.

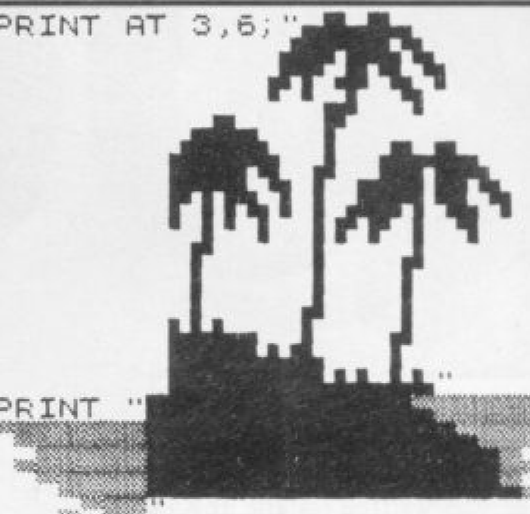
Jolly Roger was written for the 16K ZX-81 by Ron Wood, of Weston-super-Mare, Avon.



```
BE SAFE.                AT THE MOMEN
T, YOU HAVE             1000 DOUBLOO
NS ABOARD, AND          10 UNSAVOURY
 CUTTHROATS AS CREW
                        PRESS ""S""
TO WEIGH ANCHOR"
  33 PRINT "
           "
  35 IF INKEY$<>"S" THEN GOTO 35
  36 IF INKEY$="S" THEN GOTO 40
  40 CLS
  42 PRINT P$
  45 LET W=INT (RND*5)+1
  50 IF W=1 THEN PRINT AT 7,10;"
SHIP AHOY CAP""N ";N$
  55 IF W=1 THEN GOTO 150
  60 IF W=2 THEN PRINT AT 7,10;"
PIECES OF EIGHT"
  70 IF W=3 THEN PRINT AT 7,10;"
SHIVER ME TIMBERS"
  80 IF W=4 THEN PRINT AT 7,10;"
SPLICE THE MAINBRACE"
  90 IF W=5 THEN PRINT AT 7,10;"
PRETTY ";N$
  92 PRINT AT 15,7;"PRESS""S""TO
 SAIL ON..."
  95 IF W<>1 THEN GOTO 35
 150 PRINT AT 15,0;"WHAT NOW,CAP
""N ";N$;"?       ";AT 16,0;"DO W
E SAIL ON,(S),OR ATTACK,(A)?"
 155 INPUT D$
 157 IF D$="A" THEN GOTO 200
 159 IF D$="S" THEN GOTO 5900
 160 IF D$<>"A" AND D$<>"S" THEN
GOTO 155
 199 REM TELESCOPE
 200 FOR B=0 TO 20
 205 PRINT AT B,0;"████████████
████████████████"
 207 NEXT B
 208 PRINT AT 0,7;"THERE SHE BE,
CAP N"
 210 PRINT AT 3,13;"▄▄   ▄▄"
 220 PRINT AT 4,11;"▛         ▜"
 225 PRINT AT 5,10;"▛    ▀█▀    ▜
"
 230 PRINT AT 6,9;"▛     ▪ ▪
▜"
 235 PRINT AT 7,9;"▪     ▀██▀
▌"
 240 PRINT AT 8,9;"       ▪  ▪
"
 245 PRINT AT 9,9;"      ▀█▀█▀
"
 250 PRINT AT 10,9;"       █▖ ▟
"
 255 PRINT AT 11,9;"▪      █▀▀█
▪"
 260 PRINT AT 12,9;"▌      ▀█▀
▌"
 265 PRINT AT 13,9;"▙▒▒▒▒▒▒▄▄▒▒▒
▒▟"
 270 PRINT AT 14,10;"▪▒▒▒▄▒▄▒▄▒▒
▪"
 275 PRINT AT 15,11;"▙▒▒▒▒▒▒▒▒▪"
 280 PRINT AT 16,12;"▙▄▒▒▒▒▒▪"
 285 PRINT AT 17,15;"▒▒"
 290 PRINT AT 19,0;"WILL YOU FIR
E(F),OR SAIL AWAY(S)"
 300 INPUT C$
 305 IF C$="F" THEN GOTO 320
 310 IF C$="S" THEN GOTO 40
 315 IF C$<>"F" AND C$<>"S" THEN
GOTO 300
 320 REM CANNON
 321 CLS
```

```
 325 LET D=INT (RND*5)+1
 327 FOR C=0 TO 3
 328 CLS
 331 PRINT P$
 332 PRINT AT 17,3;"
                    O
 335 PRINT AT 7,10;"PRESS ""F""
TO FIRE,";AT 8,10;"CAP""N ";N$
 340 IF INKEY$="F" THEN GOTO 350
 345 IF INKEY$<>"F" THEN GOTO 34
5
 350 PRINT AT 17,16;"
";AT 18,16;"       ";AT 19,1
6;"
 351 FOR X=1 TO 20
 352 NEXT X
 355 PRINT AT 17,16;"
";AT 18,16;"           ";AT 19,1
6;"    "
 370 IF C=3 AND C>=D THEN GOTO 3
80
 375 IF C=3 AND C<D THEN GOTO 40
0
 377 NEXT C
 380 LET TR=TR+500
 382 LET CR=CR+D
 383 IF CR>=20 THEN GOTO 7000
 385 CLS
 386 PRINT P$
 387 PRINT
 388 PRINT "WELL DONE,CAP""N ";N
$
 390 PRINT "YOU SANK HER,AND ";D
;" OF HER   CREW JOINED YOURS."
 392 PRINT "YOU NOW HAVE ";TR;"
DOUBLOONS"
 395 PRINT "ON BOARD.PRESS ""S""
TO SAIL ON"
 396 IF INKEY$<>"S" THEN GOTO 39
6
 397 IF INKEY$="S" THEN GOTO 40
 400 CLS
 401 LET LI=LI-1
 405 LET CR=CR-2
 425 PRINT AT 0,5;S$
 430 PRINT
 435 IF LI=2 THEN PRINT "THEY BE
AT US,CAP""N               PEG-LE
G   ";N$
 440 IF LI=1 THEN PRINT "YOU CAN
""T WIN THEM ALL, CAP""N    PEG-
LEG DEADEYE ";N$
 445 IF LI=0 THEN PRINT "NOT YOU
RDAY,IS IT, CAP""N PEG-LEG DEADE
YE ";N$;" THE ONE-HANDED?"
 450 PRINT
 451 IF LI>0 THEN GOTO 455
 452 PRINT "THEY TOOK ALL YOUR T
REASURE"
 453 PAUSE 100
 454 GOTO 9000
 455 PRINT "THEY TOOK ALL YOUR T
REASURE.    PRESS ""S"" TO SAIL
ON"
 460 IF INKEY$<>"S" THEN GOTO 46
0
 465 IF INKEY$="S" THEN GOTO 40
5900 CLS

5905 PRINT AT 0,5;Q$
5910 PRINT AT 10,0;"DO WE SAIL T
O TREASURE ISLAND    CAP""N ";N$;
"? (Y/N)"
5915 INPUT A$
5920 IF A$="Y" THEN GOTO 5940
5925 IF A$="N" THEN GOTO 40
5930 IF A$<>"Y" AND A$<>"N" THEN
 GOTO 5915
5940 IF CR>10 THEN GOTO 5999
5950 IF CR<=10 THEN PRINT "YOU D
ON""T HAVE ENOUGH CREW FOR  THE
VOYAGE,CAP""N ";N$
5955 PRINT "PRESS ""S"" TO SAIL
ON"
5960 IF INKEY$<>"S" THEN GOTO 59
60
5965 IF INKEY$="S" THEN GOTO 40
5999 CLS
6000 PRINT AT 3,6;"
```

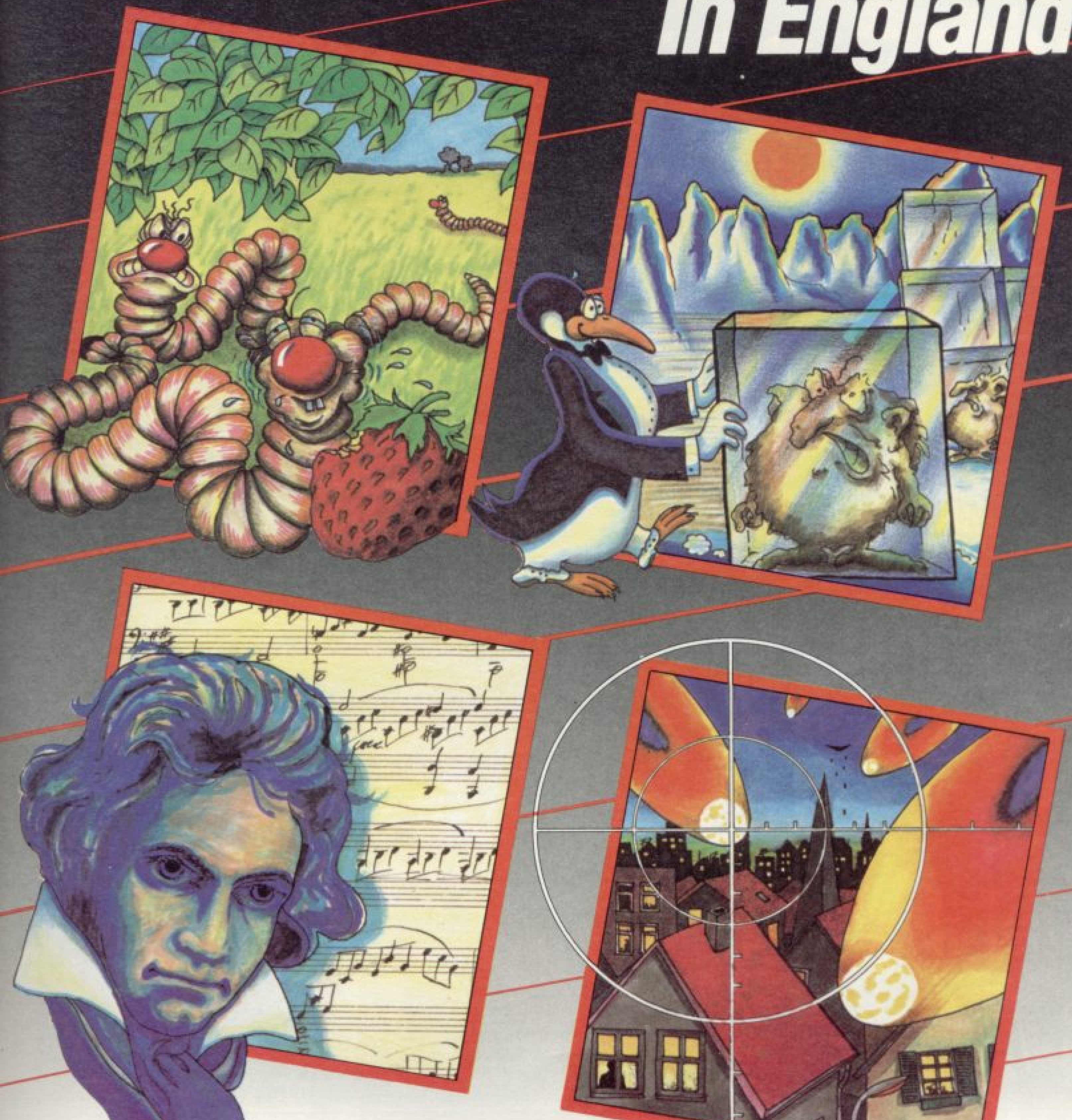


```
6005 PRINT "
"
6007 LET TI=TI+TR
6008 LET TR=0
6010 PRINT AT 10,15;"YOU NOW HAV
E";AT 11,15;TI;" DOUBLOONS";AT 1
2,15;"SAFELY BURIED.";AT 13,14;"
WILL YOU RETIRE(R)";AT 14,15;"OR
 SAIL ON(S)?"
6015 INPUT A$
6020 IF A$="S" THEN GOTO 40
6025 IF A$="R" THEN GOTO 9000
6030 IF A$<>"S" AND A$<>"R" THEN
 GOTO 6015
7000 CLS
7001 PRINT "I""M AS SICK AS A PI
RATE.."
7005 PRINT AT 2,5;S$
7010 PRINT
7015 PRINT (CR-10);" OF YOUR CRE
W HAVE DIED"
7020 PRINT "OF THE DREADED YELLO
W JACK...    YOU ONLY HAVE TEN LE
FT. HOW SAD.PRESS ""S"" TO SAIL
ON"
7025 IF INKEY$<>"S" THEN GOTO 70
25
7030 IF INKEY$="S" THEN GOTO 40
9000 CLS
9001 LET K=INT (RND*5)+1
9002 IF K=1 THEN LET L$="LATIN"
9003 IF K=2 THEN LET L$="GREEK"
9004 IF K=3 THEN LET L$="URDU"
9005 IF K=4 THEN LET L$="ESKIMO"
9006 IF K=5 THEN LET L$="SERBO-C
ROAT"
9017 PRINT AT 0,5;P$
9018 PRINT
9019 PRINT "RETIREMENT SEEMS A G
OOD IDEA,    CAP""N ";N$
9020 PRINT "WITH ";TI;" DOUBLOON
S"
9025 PRINT "YOU CAN AFFORD TO SP
END YOUR     DAYS IN IDLE LUXURY,
TEACHING ME TO SPEAK ";L$
```



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sinclair

Machine code shift

Box 1.

SPECIFICATIONS S8 — Spectrum.

GENERAL DESCRIPTION: This routine checks the present position of a figure shown on the Spectrum screen. If that figure is touching the right edge of the screen, a return is made without affecting either the position of the figure or the pointers to that position. If that figure is not touching the right edge of the screen, the pointers to the position of the figure are re-set one pixel to the right, the variables required by S4 — shift right — are set and then a call is made to S4. The setting of the variables for S4 is made to ensure that only those bytes in the screen area containing the figure are shifted.

RESTRICTION: The routine was designed for a specific figure 14 scans high and 57 pixels wide. Lines 180 and 380 will need adjustment for a figure of another size.

ON ENTRY: V4 — a two-byte variable at 72F0H and 72F1H — must point to the top left of the figure. V5 — a two-byte variable at 72F2H and 72F3H — must point to the top right of the figure. V7 — a two-byte variable at 72F4H — must point to the bottom right of the figure. V8 — a one-byte variable at 72F6H — must contain the bit number of the left-most pixel covered by the figure. S4 and S0 — down a scan — must be in memory.

ON EXIT: V4, V5, V7 and V8 will be set correctly. If the figure is not on the right edge of the screen, it will be shifted right one pixel.

USES: A, B, C, D, E, H, L, V1, V1.

RESETS: V4, V5, V7, V8.

```
7300            00100     ORG 7300H
7300  3AF672    00110 S8  LD A,(V8)      ;BIT NO. OF LEFTMOST POINT
7303  FE00      00120     CP 0
7305  CA1C73    00130     JP Z,J1        ;INTO NEXT BYTE
7308  3D        00140     DEC A
7309  32F672    00150     LD (V8),A      ;STORE NEW BIT POSITION
730C  2AF072    00160     LD HL,(V4)     ;TOP LEFT OF FIGURE
730F  22F771    00170     LD (V1),HL
7312  210E08    00180     LD HL,080EH    ;8 BYTES/14 SCANS
7315  22F971    00190     LD (V2),HL
7318  CD3072    00200     CALL S4        ;SHIFT RIGHT
731B  C9        00210     RET
731C  2AF272    00220 J1  LD HL,(V5)     ;TOP RIGHT OF FIGURE
731F  7D        00230     LD A,L
7320  E61F      00240     AND 1FH
7322  FE1F      00250     CP 1FH
7324  C8        00260     RET Z          ;RETURN IF ALREADY AT RIGHT
                00270                    ;EDGE OF SCREEN
7325  2AF072    00280     LD HL,(V4)     ;TOP LEFT OF FIGURE
7328  22F771    00290     LD (V1),HL
732B  2C        00300     INC L
732C  22F072    00310     LD (V4),HL     ;NEW TOP LEFT OF FIGURE
732F  21F472    00320     LD HL,V7       ;BOTTOM RIGHT OF FIGURE
7332  34        00330     INC (HL)
7333  21F272    00340     LD HL,V5       ;TOP RIGHT OF FIGURE
7336  34        00350     INC (HL)
7337  3E07      00360     LD A,7         ;SET A TO TOP BIT OF BYTE
7339  32F672    00370     LD (V8),A      ;NEW BIT POSITION
733C  210E09    00380     LD HL,090EH    ;9 BYTES/14 SCANS
733F  22F971    00390     LD (V2),HL
7342  CD3072    00400     CALL S4        ;SHIFT RIGHT
7345  C9        00410     RET
71F7            00420 V1  EQU  71F7H
71F9            00430 V2  EQU  71F9H
72F0            00440 V4  EQU  72F0H
72F2            00450 V5  EQU  72F2H
72F4            00460 V7  EQU  72F4H
72F6            00470 V8  EQU  72F6H
7230            00480 S4  EQU  7230H
0000            00490     END
00000 TOTAL ERRORS

J1    731C  00220  00130
S4    7300  00480  00200 00400
S8    7300  00110
V1    71F7  00420  00170 00290
V2    71F9  00430  00190 00390
V4    72F0  00440  00160 00280 00310
V5    72F2  00450  00220 00340
V7    72F4  00460  00320
V8    72F6  00470  00110 00150 00370
```

A BASIC PROGRAM last month implemented routines to shift a figure of any size up, down, left or right round the Spectrum screen. In a way it cheated by ignoring the current position of the figure and shifting the whole screen. If that was what was required, faster and simpler machine code routines could have been devised. The sophistication of S4, S5, S6 and S7 is in their ability to alter only a specified section of the screen while leaving the remainder of the screen unaffected. In other words, they should move the alligator and leave any background stationary.

To shift only those bytes which contain the figure it is necessary to set up variables to act as pointers to the present position of the figure. In this example those pointers are held in memory addresses 29424 to 29430 — or 72F0H to 72F6H. Each time the figure is moved the pointers must be adjusted. They are not like the variables at 29275 to 29180 — 71F7H to 71FCH. They must be set before entering S4, S5, S6 or S7 and they are then used by the routines as a scratchpad. In most big programs scratchpad variables need to be distinguished from those which must always keep track of certain values.

Strictly, it should not be necessary to use more than two pointers for a single figure. One pointer is needed for the

> **'The stack can be thought of as a left-luggage area for 16-bit numbers'**

address holding the top left corner of the rectangle containing the figure and the other pointer is needed to point to the bit number in the byte at that address of the left edge of the rectangle.

If those two pointers are maintained and the size of the rectangle is known, it should be possible to calculate all the other corners of the position of the figure. In practice, it is easier to hold more pointers for the other corners rather than perform repetitive calculations.

In boxes one, two, three and four with this article are routines to maintain the pointers and call the shifting routines. They maintain four pointers. V4, a pointer to the screen address of the top left of the rectangle is required for S4 — shifting a pixel right. V5, a pointer to

John Kerrigan concludes his series and shows how graphics can be moved round the screen.

Box 2.

SPECIFICATIONS S9 — Spectrum.

GENERAL DESCRIPTION: This routine checks the present position of a figure shown on the Spectrum screen. If that figure is touching the left edge of the screen, a return is made without affecting either the position of the figure or the pointers to that position. If that figure is not touching the left edge of the screen, the pointers to the position of the figure are re-set one pixel to the left, the variables required by S5 — shift left — are set and then a call is made to S5. The setting of the variables for S5 is made to ensure that only those bytes in the screen area containing the figure are shifted.

RESTRICTION: The routine was designed for a specific figure 14 scans high and 57 pixels wide. Lines 180 and 370 will need adjustment for a figure of another size.

ON ENTRY: V4 — a two-byte variable at 72F0H and 72F1H — must point to the top left of the figure. V5 — a two-byte variable at 72F2H and 72F3H — must point to the top right of the figure. V7 — a two-byte variable at 72F4H — must point to the bottom right of the figure. V8 — a one-byte variable at 72F6H — must contain the bit number of the left-most pixel covered by the figure. S5 and S0 — down a scan — must be in memory.

ON EXIT: V4, V5, V7 and V8 will be set correctly. If the figure is not on the left edge of the screen, it will be shifted left one pixel.

USES: A, B, C, D, E, H, L, V1, V1.

RESETS: V4, V5, V7, V8.

```
7350            00100      ORG 7350H
7350  3AF672    00110 S9   LD A,(V8)      ;BIT NO. OF LEFTMOST POINT
7353  FE07      00120      CP 7
7355  CA6C73    00130      JP Z,J1        ;INTO NEXT BYTE
7358  3C        00140      INC A
7359  32F672    00150      LD (V8),A      ;STORE NEW BIT POSITION
735C  2AF272    00160      LD HL,(V5)     ;TOP RIGHT OF FIGURE
735F  22F771    00170      LD (V1),HL
7362  210E08    00180      LD HL,080EH    ;8 BYTES/14 SCANS
7365  22F971    00190      LD (V2),HL
7368  CD6072    00200      CALL S5        ;SHIFT LEFT
736B  C9        00210      RET
736C  2AF272    00220 J1   LD HL,(V4)     ;TOP LEFT OF FIGURE
736F  7D        00230      LD A,L
7370  E61F      00240      AND 1FH
7372  C8        00250      RET Z          ;RETURN IF ALREADY AT LEFT
                00260                     ;EDGE OF SCREEN
7373  2AF272    00270      LD HL,(V5)     ;TOP RIGHT OF FIGURE
7376  22F771    00280      LD (V1),HL
7379  2D        00290      DEC L
737A  22F272    00300      LD (V5),HL     ;NEW TOP RIGHT OF FIGURE
737D  21F472    00310      LD HL,V7       ;BOTTOM RIGHT OF FIGURE
7380  35        00320      DEC (HL)
7381  21F272    00330      LD HL,V4       ;TOP LEFT OF FIGURE
7384  35        00340      DEC (HL)
7385  AF        00350      XOR A          ;SET A TO ZERO
7386  32F672    00360      LD (V8),A      ;NEW BIT POSITION
7389  210E09    00370      LD HL,090EH    ;9 BYTES/14 SCANS
738C  22F971    00380      LD (V2),HL
738F  CD6072    00390      CALL S5        ;SHIFT LEFT
7392  C9        00400      RET
71F7            00410 V1   EQU  71F7H
71F9            00420 V2   EQU  71F9H
72F0            00430 V4   EQU  72F0H
72F2            00440 V5   EQU  72F2H
72F4            00450 V7   EQU  72F4H
72F6            00460 V8   EQU  72F6H
7260            00470 S5   EQU  7230H
0000            00480      END
00000 TOTAL ERRORS

J1    736C  00220  00130
S5    7260  00470  00200 00390
S9    7350  00110
V1    71F7  00410  00170 00280
V2    71F9  00420  00190 00380
V4    72F0  00430  00220 00330
V5    72F2  00440  00160 00270 00300
V7    72F4  00450  00310
V8    72F6  00460  00110 00150 00360
```

the screen address of the top right is required for S5 and S6 — shifting left and up. V7, a pointer to the screen address of the bottom right is required for S7 — shifting down one scan. V8, a pointer to the bit number occupied by the left edge of the rectangle, is required for both S4 and S5.

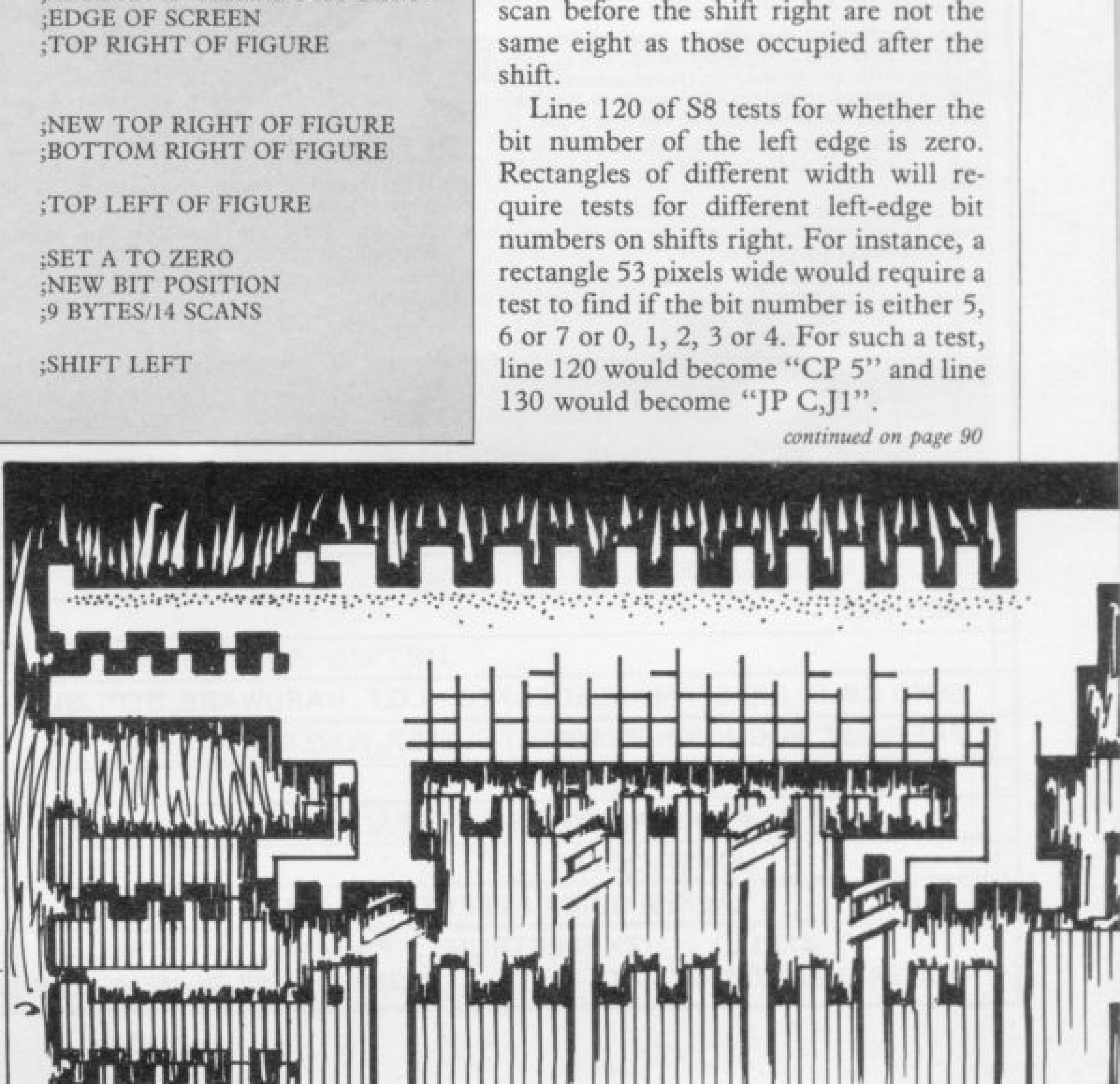
Routines S0 to S7 have been designed to be multi-purpose. Although the Basic program examples have displayed an alligator 57 pixels wide and 14 scans high, the routines can be used to display any figure of any size. Unfortunately this month's controlling routines have to be rather more specific.

Each scan of a stationary rectangle 57 pixels wide will always fit into eight addresses. If the left edge is in bit 0 of the byte held in the first address, each scan of the rectangle will occupy just bit 0 of the first address and then fill the following seven addresses. If you want to shift the rectangle one pixel left, S5 should be set to act on eight bytes per scan. If you want to shift the rectangle one pixel right, S4 should be set to act on nine bytes per scan. The reason is that the eight bytes occupied by each scan before the shift right are not the same eight as those occupied after the shift.

'Beginners are advised to beware of complicated use of the stack'

Line 120 of S8 tests for whether the bit number of the left edge is zero. Rectangles of different width will require tests for different left-edge bit numbers on shifts right. For instance, a rectangle 53 pixels wide would require a test to find if the bit number is either 5, 6 or 7 or 0, 1, 2, 3 or 4. For such a test, line 120 would become "CP 5" and line 130 would become "JP C,J1".

continued on page 90



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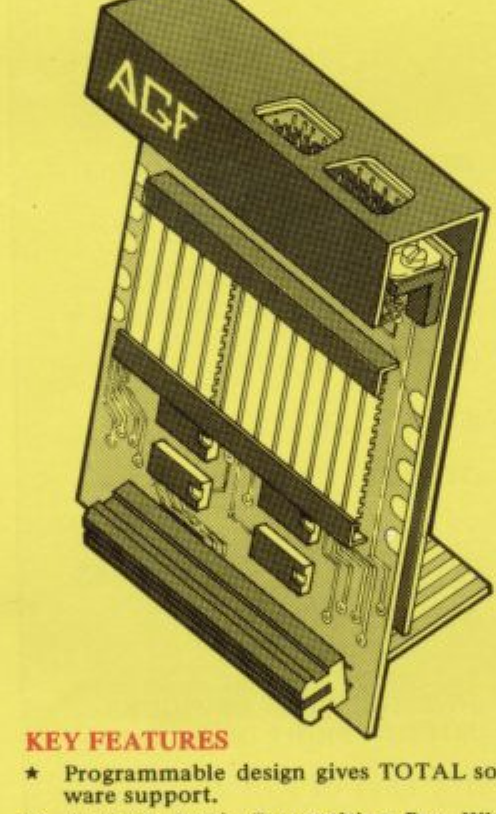
Programming is achieved by a two-digit code, which is looked up on the Programming Chart supplied, for each direction and firing button. These two numbers are then selected on a pair of leads which are clipped onto appropriately numbered strips on the interface.

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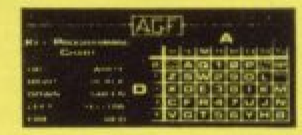


KEY FEATURES

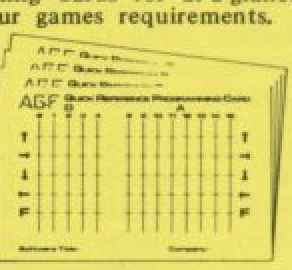
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Box 3.

SPECIFICATIONS SA — Spectrum.

GENERAL DESCRIPTION: This routine checks the present position of a figure shown on the Spectrum screen. If that figure is touching the top edge of the screen, a return is made without affecting either the position of the figure or the pointers to that position. If that figure is not touching the top edge of the screen, the pointers to the position of the figure are re-set one scan up, the variables required by S6 — shift up — are set and then a call is made to S6. The setting of the variables for S6 is made to ensure that only those bytes in the screen area containing the figure are shifted.

RESTRICTION: The routine was designed for a specific figure 14 scans high and 57 pixels wide. Line 220 will need adjustment for a figure of another size.

ON ENTRY: V4 — a two-byte variable at 72F0H and 72F1H — must point to the top left of the figure. V5 — a two-byte variable at 72F2H and 72F3H — must point to the top right of the figure. V7 — a two-byte variable at 72F4H — must point to the bottom right of the figure. V8 — a one-byte variable at 72F6H — must contain the bit number of the left-most pixel covered by the figure. S6 and S0 — down a scan — must be in memory.

ON EXIT: V4, V5, V7 and V8 will be set correctly. If the figure is not on the top edge of the screen, it will be shifted up one scan.

USES: A, B, C, D, E, H, L, V1, V2.

RESETS: V4, V5, V7, V8.

```
73A0              00100      ORG 73A0H
73A0  2AF272      00110 SA   LD HL,(V5)       ;TOP RIGHT OF FIGURE
73A3  CD0071      00120      CALL S2          ;UP A SCAN
73A6  C8          00130      RET Z            ;ALREADY AT TOP OF SCREEN
73A7  22F771      00140      LD (V1),HL
73AA  22F272      00150      LD (V58),HL      ;TOP RIGHT OF FIGURE
73AD  2AF072      00160      LD HL,(V4)       ;TOP LEFT OF FIGURE
73B0  CD0071      00170      CALL S2          ;UP A SCAN
73B3  22F072      00180      LD (V4),HL       ;NEW TOP LEFT OF FIGURE
73B6  2AF472      00190      LD HL,(V7)       ;BOTTOM RIGHT OF FIGURE
73B9  CD0071      00200      CALL S2          ;UP A SCAN
73BC  22F472      00210      LD (V7),HL       ;NEW BOTTOM RIGHT OF FIGURE
73BF  21080E      00220      LD HL,0E08H      ;14 SCANS/8 CHRS
73C2  22F971      00230      LD (V2),HL
73C5  CD9072      00240      CALL S6          ;SHIFT UP
73C8  C9          00250      RET
71F7              00260 V1   EQU  71F7H
71F9              00270 V2   EQU  71F9H
72F0              00280 V4   EQU  72F0H
72F2              00290 V5   EQU  72F2H
72F4              00300 V7   EQU  72F4H
7100              00310 S2   EQU  7100H
7290              00320 S6   EQU  7290H
0000              00330      END
00000 TOTAL ERRORS

S2    7100  00310   00120 00170 00200
S6    7290  00320   00240
SA    73A0  00110
V1    71F7  00260   00140
V2    71F9  00270   00230
V4    72F0  00280   00160 00180
V5    72F2  00290   00110 00150
V7    72F4  00300   00190 00210
```

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If the left edge occupies bit 5, the right edge occupies bit 1 and a shift right will place the rectangle in the same seven addresses it occupied before the shift. If the left edge occupies bit 4, the right edge occupies bit 0 and a shift right will involve eight addresses.

Take another example. Figures which are a precise number of bytes wide will always involve the same number of addresses on shifts right or left. A rectangle 56 pixels wide would always require S4 and S5 to act on eight bytes per scan. If the left edge occupied bit 7, each scan of the rectangle would fill seven bytes. A shift in either direction would fill one bit of another byte. If the left edge occupied any bit other than bit 7, each scan would affect eight addresses and those eight addresses would contain the figure after a shift in either direction.

Summing up, there are three situations. If the width in pixels divides by eight, the same width is required for S4 and S5, no matter which bit number the left edge occupies. If the remainder after dividing the width in pixels by eight is one, the routine S8 can be adapted easily. In other circumstances the carry flag rather than the zero flag should be used for the jump in line 130 of S8. The same logic will be required for adaptations to S9, the routine to control shifts left.

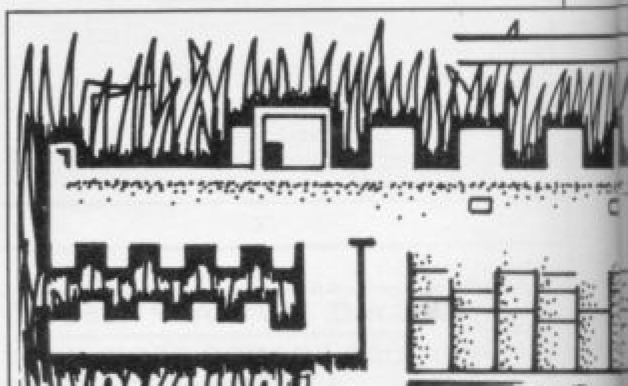
Apart from controlling the pointers, setting the opening requirements of S4, S5, S6 or S7 and calling one of those routines, S8 to SB also ensure that the figure cannot escape from the edge of the screen. There are no problems for SA and SB to check the top and bottom edges of the screen. S0 and S2 — down and up a scan — use the zero flag to indicate the edges but S8 and S9 have to contain their own tests for the right and left edges of the screen.

S8 has the relevant test in lines 240, 250 and 260. The bytes at the right edge of the screen are the only ones in screen memory with all the bottom five bits of the least significant byte of the address set, that is equalling 1. S9 has the relevant test in lines 240 and 250. The bytes at the left edge of the screen are the only ones in screen memory with all the bottom five bits of the least significant byte of the address re-set, that is equalling 0.

Box five contains the Basic program to poke the latest routines into memory and then test them using the l, r, u and d keys. As in last month's article, the program assumes that you have recorded the code of the routines in the previous months' articles. The program tries to load that code in line 20 under the name "ALLINIT".

Our shifting routines require values to be passed to routines via known variable locations. A more-commonly-used alternative is to pass values to small subroutines via the stack. The stack is an area of internal memory. The Basic program sets the stack in the area below 28671, or 6FFFH, with the CLEAR instruction in line 10.

Assembly language beginners are advised to beware of over-complicated use of the stack. Even if we do not intend to use stack instructions, we have to understand them to understand how other people's programs work. In particular,



the Spectrum ROM has routines which require various values to be placed on the stack before they are entered.

The stack can be thought of as a left-luggage area for 16-bit numbers. All numbers on the stack are 16-bit or two-byte numbers. That means that if you want to save the current contents of the A register, you have to save the contents of the flag register as well. For stack operations all the registers are taken in pairs. Saving a register pair on the stack is called PUSHing that register pair. Re-claiming a 16-bit number off the stack and putting it into a register pair is called POPping that register pair.

The stack may contain 20 two-byte numbers. That does not mean that you can choose which of the 20 you wish to POP next. The stack keeps track of a current position with the two-byte register, the stack pointer. An instruction like POP DE will return whatever was the last number saved on the stack. That number will be at the bottom of the stack. POP DE will also increment the stack pointer twice.

> 'The stack may contain 20 two-byte numbers but you cannot choose which of the 20 to POP next'

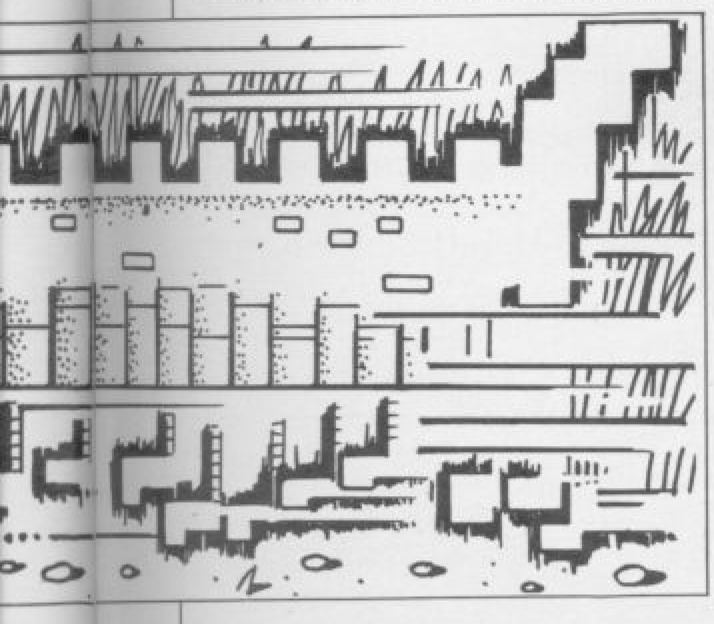
If POP DE is followed by PUSH HL, the present number in HL will be added to the bottom of the stack, taking the locations held previously by the number now POPped into DE. The stack pointer will also be decremented twice.

So PUSH BC, PUSH DE, POP BC, POP DE would exchange the contents of BC and DE, leave the stack pointer set at its original position, and reproduce the two numbers immediately below the stack. One reason for using the stack to pass values, rather than leaving them in known variable locations, is that stack operations are faster. That increased speed is unlikely to be important to your routines but is is important to the much more complicated routines in the Spectrum ROM.

Apart from PUSHes and POPs, the stack is also used by CALLs and RETurns. A CALL has the effect of PUSHing the present PC, or program counter, register contents and then filling the program counter with the addressed called. A RET has the effect of POPping the next number off the stack into the PC register. That means that passing a value to a subroutine via the stack will involve the subroutine peeling-off the return address, safeguarding it, accessing the value and then PUSHing the return address before the standard RET. That must be done with care to ensure that the stack does not either grow further and further down in memory or disappears above the CLEARed address and covers the machine code.

The general rule is that in each subroutine for each possible run the number of PUSHes must equal the number of POPs and the number of CALLs must equal the number of RETurns.

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Box 4.

SPECIFICATIONS SB — Spectrum.

GENERAL DESCRIPTION: This routine checks the present position of a figure shown on the Spectrum screen. If that figure is touching the bottom edge of the screen, a return is made without affecting either the position of the figure or the pointers to that position. If that figure is not touching the bottom edge of the screen, the pointers to the position of the figure are re-set one scan down, the variables required by S7 — shift down — are set and then a call is made to S7. The setting of the variables for S7 is made to ensure that only those bytes in the screen area containing the figure are shifted.

RESTRICTION: The routine was designed for a specific figure 14 scans high and 57 pixels wide. Line 220 will need adjustment for a figure of another size.

ON ENTRY: V4 — a two-byte variable at 72F0H and 72F1H — must point to the top left of the figure. V5 — a two-byte variable at 72F2H and 72F3H — must point to the top right of the figure. V7 — a two-byte variable at 72F4H — must point to the bottom right of the figure. V8 — a one-byte variable at 72F6H — must contain the bit number of the left-most pixel covered by the figure. S6 and S0 — down a scan — must be in memory.

ON EXIT: V4, V5, V7 and V8 will be set correctly. If the figure is not on the top edge of the screen, it will be shifted down one scan.

USES: A, B, C, D, E, H, L, V1, V2.

RESETS: V4, V5, V7, V8.

```
73D0              00100      ORG 73D0H
73D0  2AF472      00110 SB   LD HL,(V7)     ;BOTTOM RIGHT OF FIGURE
73D3  CD0070      00120      CALL S0        ;DOWN A SCAN
73D6  C8          00130      RET Z          ;ALREADY AT BOTTOM OF SCREEN
73D7  22F771      00140      LD (V1),HL
73DA  22F472      00150      LD (V7),HL     ;BOTTOM RIGHT OF FIGURE
73DD  2AF072      00160      LD HL,(V4)     ;TOP LEFT OF FIGURE
73E0  CD0070      00170      CALL S0        ;DOWN A SCAN
73E3  22F072      00180      LD (V4),HL     ;NEW TOP LEFT OF FIGURE
73E6  2AF272      00190      LD HL,(V5)     ;TOP RIGHT OF FIGURE
73E9  CD0070      00200      CALL S0        ;DOWN A SCAN
73EC  22F272      00210      LD (V5),HL     ;NEW TOP RIGHT OF FIGURE
73EF  21080E      00220      LD HL,0E08H    ;14 SCANS/8 CHRS
73F2  22F971      00230      LD (V2),HL
73F5  CDC072      00240      CALL S7        ;SHIFT DOWN
73F8  C9          00250      RET
71F7              00260 V1   EQU  71F7H
71F9              00270 V2   EQU  71F9H
72F0              00280 V4   EQU  72F0H
72F2              00290 V5   EQU  72F2H
72F4              00300 V7   EQU  72F4H
7000              00310 S0   EQU  7000H
72C0              00320 S7   EQU  72C0H
0000              00330      END
00000 TOTAL ERRORS

S0     7000  00310   00120 00170 00200
S7     72C0  00320   00240
SB     73D0  00110
V1     71F7  00260   00140
V2     71F9  00270   00230
V4     72F0  00280   00160 00180
V5     72F2  00290   00190 00210
V7     72F4  00300   00110 00150
```

continued from page 91

Thus to access a value from the stack from within a subroutine, when it was placed on the stack from outside the subroutine, POP BC peels-off the return address; EXX if BC is to be used in this subroutine; POPDE — this is the value we want; the routine; PUSH any register pair; EXX — if we EXXed previously, PUSH BC; and RET.

The EXX instruction exchanges the contents of the shadow BC, DE and HL with the contents of the current registers. It does not affect the A register or the flag register. In most Z-80-based machines it is a very useful way of saving register contents while we use the register for some other purpose.

Spectrum Basic does not save the value in the shadow HL before accessing your machine code routines with RANDOMISE USR. The Spectrum ROM may want that value when you return to Basic. If you intend to use the shadow HL, you should save its contents first and then replace them before returning. It is sensible to save the shadow HL if the instruction EXX appears anywhere in your code.

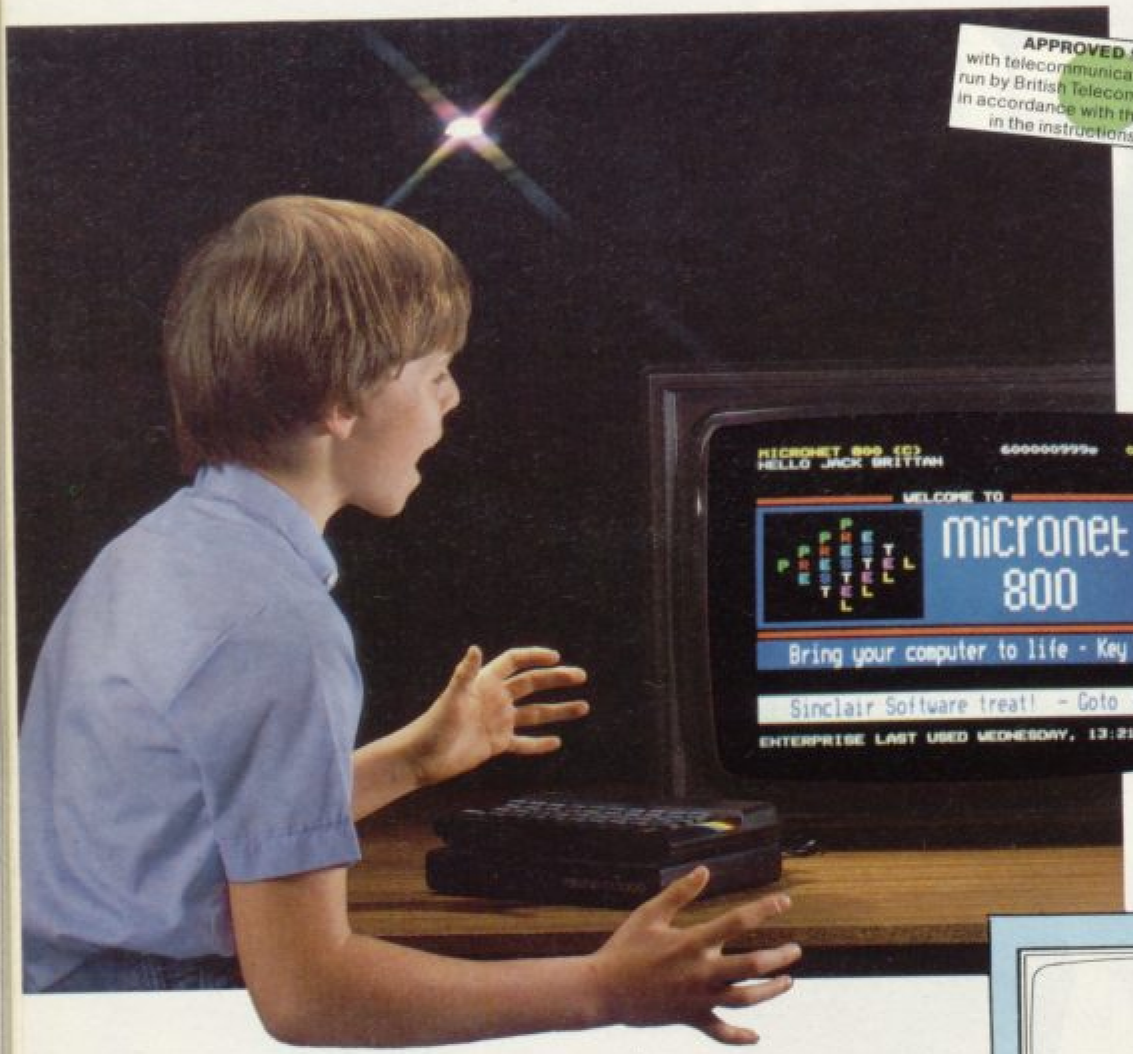
At this stage I am aware of all those areas with which I have not dealt in this series. I hope readers have found some of the information useful and will be able to treat the routines as the basis of a library of routines for manipulating figures on the Spectrum screen.

Box 5.

```
10 CLEAR 28671
20 LOAD "ALLINIT" CODE
30 REM INITIAL V1,V2,V3,V4
40 DATA 10,72,34,112,8,14
50 FOR A=29175 TO 29180: READ B: POKE A,B: NEXT A
60 RANDOMIZE USR 29184
70 REM S8 MACHINE CODE
80 DATA 58,246,114,254,0,202,28,115,61,50,246
90 DATA 114,42,240,114,34,247,113,33,14,8,34
100 DATA 249,113,205,48,114,201,42,114,125
110 DATA 230,31,254,31,200,42,240,114,34,247
120 DATA 113,44,34,240,114,33,244,114,52,33
130 DATA 242,114,52,62,7,50,246,114,33,14,9
140 DATA 34,249,113,205,48,114,201
150 FOR A=290440 TO 29509: READ B: POKE A,B: NEXT A
160 REM S9 MACHINE CODE
170 DATA 58,246,114,254,7,202,108,115,60,50,246
180 DATA 114,42,242,114,34,247,113,33,14,8,34
190 DATA 249,113,205,96,114,201,42,240,114,125
200 DATA 230,31,200,42,242,114,34,247,113,45
210 DATA 34,242,114,33,244,114,53,33,240,114
220 DATA 53,175,50,246,114,33,14,9
230 DATA 34,249,113,205,96,114,201
240 FOR A=29520 TO 29586: READ B: POKE A,B: NEXT A
250 REM SA MACHINE CODE
260 DATA 42,242,114,205,0,113,200,34,247,113
270 DATA 34,242,114,42,240,114,205,0,113,34
280 DATA 240,114,42,244,114,205,0,113,34,244
290 DATA 114,33,8,14,34,249,113,205,144,114,201
300 FOR A=29600 TO 29640: READ B: POKE A,B: NEXT A
310 REM SB MACHINE CODE
320 DATA 42,244,114,205,0,112,200,34,247,113
330 DATA 34,244,114,42,240,114,205,0,112,34
340 DATA 240,114,42,242,114,205,0,112,34,242
350 DATA 114,33,8,14,34,249,113,205,192,114,201
360 FOR A=29648 TO 29688: READ B: POKE A,B: NEXT A
370 REM INITIAL VALUES OF V4,V5,V7,V8
380 DATA 10,72,17,72,49,77,7
390 FOR A=29424 TO 29430: READ B: POKE A,B: NEXT A
1000 PAUSE 0
1010 IF INKEY$="r" THEN RANDOMIZE USR 29440
1020 IF INKEY$="l" THEN RANDOMIZE USR 29520
1030 IF INKEY$="u" THEN RANDOMIZE USR 29600
1040 IF INKEY$="d" THEN RANDOMIZE USR 29648
1050 GO TO 1000
```


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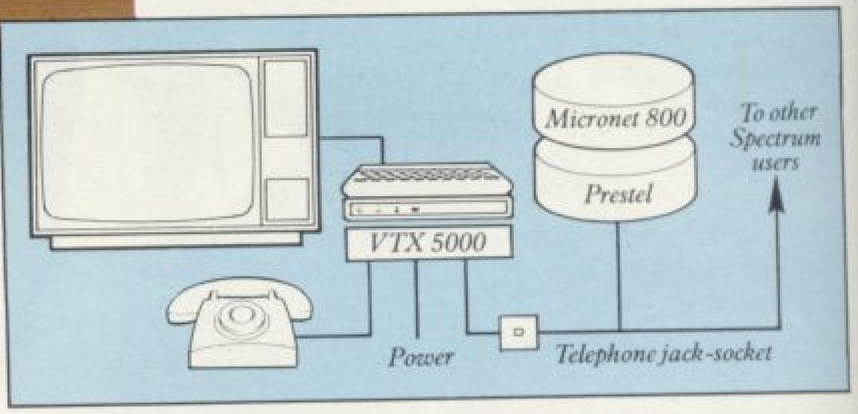




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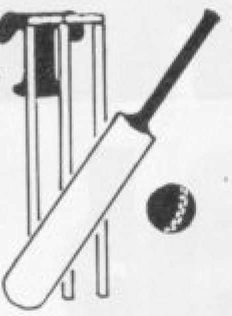
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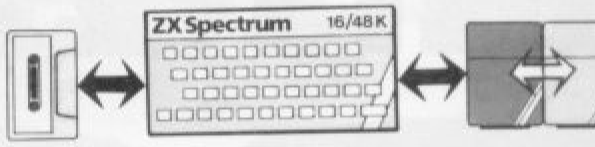
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The Spectrum soldiers on

Nicole Segre talks to Pierre-Paul Struye, Belgian collector of military helmets and Sinclair enthusiast

When Belgian-born Pierre-Paul Struye, general secretary of a multi-national cement company, decided to organise a reunion dinner for his former comrades in the Royal Belgian Air Force at the end of last year, he let his ZX-81 do most of the work. The machine kept track of who was to be invited, who had accepted, who had paid for tickets, and whether they were taking their wives. "It proved to be a very successful event," Struye says.

Now 54, Struye spends an increasing amount of time using or programming a computer. His chief hobby, however, is collecting military helmets, and that is why he bought a computer in the first place.

"I became interested in the subject early in 1983 because my eldest son was then doing a course in computer studies in the United States. It was he who suggested a computer might be useful for keeping a check on my collection. I hunted in magazines and settled on the ZX-81 because it was so cheap. It has served me very well," he says.

Struye owns about 280 military helmets — "a good collection by European standards," he says — and has them all listed on his Masterfile program from Campbell Systems. He divides his time between Paris and Brussels and the program enables him to learn at a glance in which of his various storage places any particular item is to be found.

"Before, I had it all written on scraps of paper," he says. "This is much more satisfactory."

The program also tells him which helmets he has in duplicate and is willing to offer to other collectors, and which he needs to fill gaps in his collection — at the moment, chief among them is a first world war British helmet with an anti-shrapnel visor. Another facility he likes is being able to classify helmets according to their provenance or date.

Struye sends printout listings of his helmets regularly to fellow collectors all over the world and has recently been using his computer to send order forms for a book about helmets which he is writing in collaboration with an international team of authors.

"The book will appear in English and French and so far as I know it will be the first work of its kind on the market," he says.

Struye has extended the use of his ZX-81 into other areas. Not only did it help him organise his air force reunion dinner but when three of his five children were married last year, Masterfile again proved invaluable. It provided him with a complete list of friends and relatives, sorted who was to be invited to the ceremony and who only to the reception, checked who was attending and provided a head count for caterers.

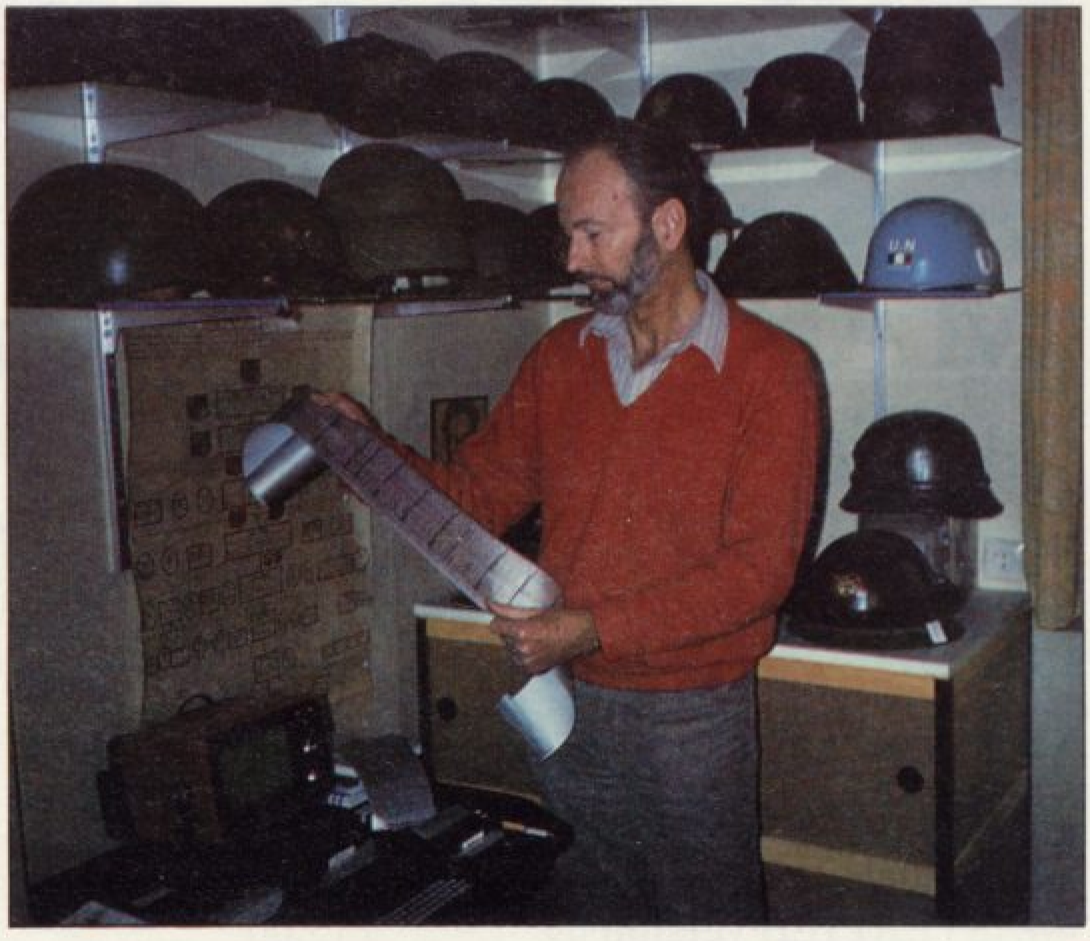
"I realise that not everyone has to deal with three weddings in one year," he says, "but if you do, a ZX-81 can save a good deal of trouble."

Although Struye bought his computer primarily to put some method into his collection of helmets, not to mention reunion dinners and wedding arrangements, he also thought it would be a useful introduction to computing.

"My company is not yet computerised," he says, "but it is only a matter of time. I would like to see all those in managerial positions having their own VDUs and I would like to be as fully-informed as possible when we have to decide which systems to install."

With that aim in view, Struye has turned his hand to programming. His first effort was a simulation program,

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designed to help deal with the problem of a subsidiary company which was running at a loss, setting out the various possible courses of action and what the likely outcome would be.

"It took me several days — and nights — to write it," Struye recalls. "I found that once I started, I could not stop. It is extraordinary how you do not notice time passing when you are programming."

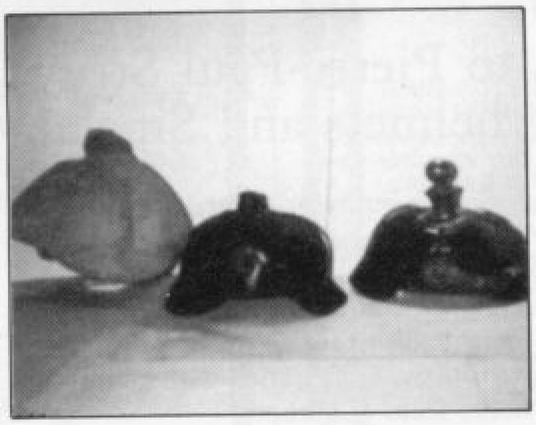
Early this year, Struye decided to go on to better things and bought a 48K Spectrum which, he says, is now becoming more readily available in France and Belgium. He is working on a program for the new machine which will calculate the nett pay of all his company's employees after tax has been deducted. He plans to use it to work out salaries when sending staff overseas.

"I have not finished it" he says. "My wife does not like me 'playing' with my computers, so I have to fit in programming when she is away in Brussels."

Next on his agenda is a budget control program, although Struye does not yet know if he will write it himself or use the Microsphere Omni-Calc.

"There is plenty of superb software for the Spectrum," he says. "I have been using Tasword for word processing and although the Spectrum keys are not ideal, the program is excellent." He is equally pleased with VuCalc, which he uses for his personal accounts.

One aspect of micros in which Struye is not interested is games. "They are a terrible waste of time," he says categorically. "Programming is much more amusing. I find solving the problems of logic it poses fascinating."



Although now the proud owner of a Spectrum, Struye is still full of praise for the ZX-81. "It is an ideal introduction to computing and it can achieve a tremendous amount of work," he says. "Unless you are an avid games player, the lack of colour is no disadvantage."

He is now looking for a program which will convert his ZX-81 programs for the Spectrum; he has tried Slowloader from East London Robotics but so far has not been able to make it work.

Meanwhile, he is looking forward to acquiring a Microdrive. "The only disadvantage of the Spectrum is the time you have to spend loading and saving," he says. "It will be wonderful when that problem disappears." As for the QL, it is not yet high on his list of priorities. "It is a professional machine," he says, "and for the moment my needs are purely personal."

Besides loading and saving, Struye has encountered only one other difficulty with his Spectrum, or rather with a ZX printer which sometimes prefers to eat paper rather than issue it in a steady stream. Because of a tip from a fellow Spectrum owner, he has found that bending the springs on either side of the paper feed to tighten them solves the problem.

So far as he knows, Struye is the only collector of military helmets using a computer in the pursuit of his hobby but he strongly recommends others to follow his example. "A ZX-81 can not only make things easier but is great fun", he says.

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GLOSSARY

Basic — Beginners' All-purpose Symbolic Instruction Code. A programming language resembling English which is used by beginners because most popular microcomputers have it as standard.
Bug — an error in a program.
EPROM — Erasable Programmable Read-Only Memory. Semi-permanent storage. Information is not erased if the power is turned off in the computer. Programs can be erased by subjecting the memory chips to ultra-violet light. The memory can then be re-programmed using an electrical device called an EPROM blower.
Interface — RS232 and Centronics. A device which enables other computers or add-ons, such as printers, to be connected to the computer. It converts non-standard signals from add-ons to the standard signals of the computer in use.
Kilobyte — (K). A measurement of memory size. Most machines use 16K as a minimum but 48K is generally agreed to be necessary for serious work.
Machine code — an electronic pulse code used by the computer to perform functions and communicate with memory and other devices.
Mnemonics — abbreviated instructions — for example LD for Load — used in machine language programming.
Motherboard — an external printed circuit board which is used like a multi-way plug planner. It enables other printed circuit boards, such as graphics boards and colour boards, to be slotted-in.
Port — a link to the outside world which can be used by programs and the computer.
PCB — printed circuit board. A board which has on it the electronic circuits of the computer.
RAM — Random Access Memory. Information and programs can be stored in this type of memory as electronic pulses which conform to a set of numbers — machine language — in which programs are represented in the computer. When the power is turned off the information will be lost.
ROM — Read Only Memory. Information stored in this type of memory is not lost when the power is switched off.
Software — programs which control the operation of the computer.
Syntax error — a bug caused by incorrect use of a programming language.



Our easy-to-follow guide for new owners

The basic route to a habit-forming hobby

BUYING a Sinclair machine can be the start of a life-time's obsession with home computing. It is easy, however, to become discouraged if everything does not go according to plan from the beginning.

For those with only a little knowledge of computers and their capabilities, the best way to approach the machines is to abandon any ideas for special uses. While the 48K Spectrum is big enough for simple uses in small businesses, the range of Sinclair computers does not contain machines for major uses. It is better to become accustomed to the many facilities and then decide how you wish to use them.

Begin by unpacking your machine, overcoming your surprise at its size and weight and, following the manual, set up the system. If you cannot get the K on the screen, check that everything is plugged into its correct socket and re-set the machine by pulling-out the power plug for one second and try tuning-in again. If still nothing appears, check the power supply unit by shaking it. If it rattles, return it. If it is satisfactory, check your system with that of a friend.

If you have a Spectrum you will have received an introductory booklet which explains what the computer can do and giving detailed instructions on how to set it up. Also included is a fault-finding guide.

Once the K appears you are ready to begin learning about your machine. It can prevent family arguments if you can afford a separate television set for your system. It also makes life easier if you find somewhere to leave your equipment set up permanently. You will find that a few power sockets are needed and a four-way block connector on a short length of extension cable will help to tidy trailing leads.

When using a Spectrum, a television set has to be more finely-tuned than when using a ZX-81 because of the added dimension of colour. If the set is not tuned properly, the colours will look hazy instead of sharp and clear. If no colour can be seen when it is switched on, the power supply or the television set may be at fault.

Some users have experienced some difficulty with some television sets, which include Hitachi, Grundig and Toshiba. Sets which many people have found compatible include the Sony Trinitron, Fidelity and Ferguson. Recent changes in the ULA should make more sets compatible.

The manuals are written in great detail and are reasonably easy to follow. Some of the chapters may not seem immediately relevant but it is worthwhile reading them as you might miss something important.

Patience is needed at that stage to learn the ways in which the computer will accept information. It is tempting to try to enter programs before you are ready but that is likely to lead to errors. For example, words like AND, THEN and AT should not be typed-in letter by letter.

By the time you have reached chapter 11 in the ZX-81 manual and chapter 19 in the Spectrum manual you should have accumulated sufficient knowledge to be

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able to type-in other people's programs, such as those in *Sinclair User* and *Sinclair Programs*, without too much difficulty.

It is important when using the ZX-81 that it is not jolted. Some of the connections can easily work loose and everything which has been entered will be lost.

The manuals are not to everyone's liking and if you find them difficult to follow a number of books on the market can help you. Find the one which suits you best.

As a way of relaxing you can buy some of the growing range of commercially-produced software. That can be loaded directly from cassette but make sure that your machine is big enough to take the tapes you buy.

For the ZX-81 there are a few tapes for the unexpanded 1K machine but the majority require the 16K RAM pack. Similarly on the Spectrum most companies are taking advantage of the possibilities provided by the larger 48K machine rather than providing cassettes for the 16K.

The tapes can vary in quality and it is advisable to read the reviews in *Sinclair User* and use your judgment to find the best.

An alternative method to learn about both the ZX-81 and the Spectrum is to plunge in at the deep end and see what the machines will do. Refer to the manuals when you have difficulties. You can ignore the functions and calculations initially and experiment with PRINT statements to obtain the feel of the machines.

You may already have heard about the problem involved in SAVEing and



LOADing your own cassettes. The manual gives detailed instructions but many of the early ZX-81s would not accept tapes from some recorders. That problem is said to have been overcome but there can still be difficulties.

Usually they occur when LOADing tapes recorded by other people. One simple method to overcome this is to wind the tape to the middle of the program and type LOAD "" followed by NEWLINE; then increase the volume of the recorder slowly with the tape running until the television screen shows four or five thick black bands. If you then re-wind the tape, the program should LOAD normally.

LOADing and SAVEing on the Spectrum is much easier and faster than the ZX-81. One difference is that when SAVEing on the Spectrum the LOAD lead must be disconnected either at the recorder or the Spectrum.

Finally, a health warning. Apart from any practical uses, computing with your Sinclair machine can be a very entertaining hobby and is almost certainly habit-forming. You may easily find yourself crouched over your machine, red-eyed, in the early hours of the morning thinking that in another five minutes you will solve the problem. Try to break that habit by getting into the fresh air and meeting other Sinclair users.

By obtaining a Sinclair computer you find that you have joined a not very exclusive club with many thousands of members, many of whom would be only too happy to advise you if you have difficulties.

Make sure of your regular copies of *Sinclair User* and *Sinclair Programs* and you can be guaranteed many happy hours.

NUMBER RACE

NUMBER RACE is a simple program written for the ZX-81 by Philip Taylor of Rowlands Castle, Hants. Once the program is RUN you will be asked to input the lane in which you think the winning number will run. There is a choice of nine lanes. The results of the game are given on completion and you will be told if you have won or lost.

```
 10 PRINT "LANE ?"
 20 INPUT B
 30 LET B=B+6
 40 FOR F=1 TO 9
 50 PRINT AT 0,5;B-6;AT F+6,0;F;AT F+6,10;CHR$ (F+156);AT F+6,28;""

 60 NEXT F
 70 LET K=INT (RND*9)+7
 80 LET Z=9
 90 LET Z=Z+1
100 PRINT AT K,Z;
110 IF PEEK (PEEK 16398+256*PEEK 16399)=0 THEN GOTO 90
120 PRINT AT K,Z;" ";CHR$ (K+150)
130 IF Z=27 THEN GOTO 150
140 GOTO 70
150 IF B=K THEN PRINT AT B,3;"won"
160 IF B<>K THEN PRINT AT B,3;"lost"
```

AS YOUR starship hurtles to the ground leaving behind a trail of asterisks, you must attempt to dock on the moving landing pad.

Use key 5 to move left and 8 to move right. **Lander** was written for the 1K ZX-81 by Colin Flisk of Altrincham, Cheshire.

LANDER

LANDER
LANDER
LANDER
LANDER

```
  10 LET S=0
  20 CLS
  25 PRINT AT 0,0;S
  30 LET C=0
  40 LET A=1
  45 LET Z=INT (RND*13)+7
  50 LET B=10
  60 LET A=A+1
  70 LET B=B+(INKEY$="8")-(INKEY
$="5")
  80 LET C=C+1
  90 PRINT AT C-1,B-1;"  *  "
 100 PRINT AT C,B;"▖▟▙▗"
 110 IF B=A AND C=Z-1 THEN GOTO
150
 120 IF C=20 THEN GOTO 200
 130 PRINT AT Z,A;" ▒▒▒▒"
 140 GOTO 60
 150 LET S=S+10
 170 PAUSE 50
 180 GOTO 20
 200 PRINT AT C,B;"▒▒▒"
```

Variables used by the program:

S = score.
A = landing pad position across screen.
B = ship's position across screen.
C = ship's position down screen.
Z = landing pad position down screen.

10 Make the starting score 0 and. . .
20 Clear the screen.
30 Print the score.
40 Start the landing pad at the left of the screen.
45 Find a random position for the landing pad down the screen which is at least seven lines down but not more than 20.
50 Start the ship in the middle of the screen.

This is the start of the main play loop. The program works its way through all the lines to line 140 and then returns to that point and loops through again, unless told to do something else.

60 Increase the position of the landing pad across the screen.
70 Find the new position of the ship across the screen. If you are pressing the 8 key, the expression (INKEY$="8") will be true and will equal 1; if not, it will equal 0. The same applies to the 5 key. If both are being pressed, the INKEY$ function will not work, as it can recognise only one key at a time. That kind of mathematics is known as Boolean algebra; for more information see chapter 10 of the manual.
80 Increase the position of the ship down the screen.
90 Prints the trail left by the ship.
100 Prints the ship.
110 If the across and down positions match, the ship has landed, so go to the extra lines which increase the score and start a new game.
120 If the ship has reached the bottom of the screen, go to the end of the game.
130 Prints the landing pad.
140 Go back to the start of the play loop.

The increase score routine. If you landed in line 110 the program goes to line 150 to increase the score and start a new game. When writing a program it is best to put all routines which are not often used outside of the main play loop. In that way the game will be a little faster, as it does not have to look through so many lines.

150 Increase the score by 10.
160 Returns to the start of the game but does not re-set the score.
170 The end of the game. Print the crashed ship.

72 COLOURS

CHRISTOPHER SMITH of Dagenham, Essex wrote **72 Colours** for the 16K Spectrum. Once RUN, the colours appear on the screen and the two squares at the top show which of the eight Spectrum colours is being used to achieve that colour.

```
  1 REM SPECTRUM COLOUR
  5 BORDER 7: INK 0: PAPER 7: B
RIGHT 0: OVER 0: INVERSE 0: FLAS
H 0: CLS
  10 LET a= BIN 01010101: LET b=
 BIN 10101010
  20 FOR f=0 TO 15: READ x: POKE
 USR "a"+f,x: NEXT f
  30 DATA a,b,a,b,a,b,a,b
  40 DATA 255,129,129,129,129,12
9,129,255
  45 FOR g=1 TO 20: PRINT  AT g,
0;"(g5)"; AT g,31;"(ig5)": NEXT
g
  47 FOR g=0 TO 31: PRINT  AT 1,
g;"(ig3)"; AT 20,g;"(g3)": NEXT
g
  50 FOR p=0 TO 7: FOR i=0 TO 7

  60 LET a$="AAAAAAAAAAAAAAAAAAA
AAAAAAAAAAA"
  70 PRINT  AT 0,0; PAPER i; INK
 0;"B"; INK 0; PAPER 7;"(";i;")
+ "; PAPER p; INK 0;"B"; INK 0;
PAPER 7;"(";p;") = (BRIGHT 0/1).
.."
  80 FOR a=2 TO 10: PRINT  AT a,
1; INK i; PAPER p;a$: NEXT a
  90 FOR a=11 TO 19: PRINT  AT a
,1; INK i; PAPER p; BRIGHT 1;a$:
 NEXT a
 100 PRINT  AT 21,2;"PRESS ANY K
EY TO CONTINUE..."
 110 FOR t=0 TO 500
 120 IF  INKEY$  <> "" THEN  GO
TO 130
 125 NEXT t
 130 BEEP .01,-5: PRINT  AT 21,0
;"
  ": NEXT i: NEXT p
 133 FOR g=0 TO 30: NEXT g
 135 FOR f=0 TO 21: PRINT  AT f,
0; PAPER 7;"
               ": NEXT f
 140 PRINT  AT 10,0;;"(ig4:30*g3
:g7)"; AT 11,0;"(ig5)"; AT 11,31
;"(g5)"; AT 12,0;"(ig1:30*ig3:ig
2)"
 150 PRINT  AT 11,2;"ANY KEY TO
RUN PROGRAM AGAIN"
 160 IF  INKEY$ ="" THEN  BORDER
 1: BORDER 2: BORDER 3: BORDER 4
: BORDER 5: BORDER 7: PAUSE 1: G
O TO 160
 170 CLS : RUN
 200 STOP
```



mission

TEN POINTS are gained each time you shoot the invader heading towards earth intent on taking over. Use keys 5 and 8 to move left and right and 0 to fire.

Mission 1 was written for the 1K ZX-81 by Colin Flisk, of Altrincham, Cheshire.

```
  10 LET S=0
  20 LET C=10
  30 LET A=1
  40 LET B=1
  50 LET B=B+1
  60 LET C=C+(INKEY$="8")-(INKEY
$="5")
  70 IF B=30 THEN LET B=0
  80 IF B=0 THEN LET A=A+2
  90 PRINT AT A,B;"▗█▖"
 100 IF A=15 AND B=29 THEN STOP
 110 PRINT AT A,B;"   "
 120 PRINT AT 20,C;" ▄█▄ "
 130 IF INKEY$="0" THEN PRINT AT
 A,C+2;"*"
 140 IF INKEY$="0" AND C=B THEN
GOTO 160
 150 GOTO 50
 160 PRINT AT A,B+1;"▒*▒"
 170 LET S=S+10
 180 PRINT AT 0,0;S
 190 PAUSE 50
 200 GOTO 50
```

Trapping the errors will ensure first-time running

THE FIRST error code encountered by most Sinclair users is the flashing "S" on the ZX-81 or "?" on the Spectrum, which indicates a syntax error in a sentence. Experience and the manual soon show that it is caused usually by typing-in a keyword letter by letter, or by bad punctuation, for example omitting a semi-colon or an inverted comma.

The most frequently-occurring error code is "2" — variable not found. A variable is a letter which has been given a numeric value. When you enter "LET a=2" you are defining a variable. Error code 2 results when the computer reaches a variable in the program to which you have so far given no value.

Check the line which the computer specifies. If it is your program, give a value to the variable or remove it. If you are copying the program, look back in the listing to see which line you have missed.

Although the majority of error codes are explained adequately in the manuals, the report "B-Integer out of range" can be confusing. An integer is a whole number — 1 is an integer, 1.5 and 1½ are not. That code occurs most frequently when you try to print something beyond the limits of the screen.

PRINT AT 0,31; "a" is acceptable and will print a letter "a" at the top right of the screen. PRINT AT 0,32; "a" would not be possible. The integer 32 would be out of range, resulting in error code "B". That would also happen if the computer were instructed to PRINT AT 0,31;"ab". It would still be trying to print a character beyond the limits of the screen.

That error is more difficult to detect if variables have been used as co-ordinates and your character, or series of characters, is being printed in varying positions. If the instruction PRINT AT 0,x;"a" produces report code B, make sure that the value of x never increases beyond 31.

On the Spectrum "B-integer out of range" is also often found when you are POKEing-in user defined graphics. The biggest number which can be POKEd-in this case is 255 or BIN 11111111. In that case the error code will occur in the line containing the POKE statement. In most cases, though, the error will have occurred in one of the DATA lines in the program.

A very frequent error code produced on the Spectrum is "E-Out Of Data". That will occur in a line containing a READ statement. The error code, though, will have occurred in one of the program DATA lines, which may be nowhere near the READ line. A READ command sends the computer to a DATA line to collect the next piece of DATA contained there. That is often done using a FOR, NEXT loop, especially when graphics are being set up.

FOR n=1 TO 8: READ n will send the computer to the DATA lines eight times, for eight separate pieces of information. If there are only seven pieces of DATA there it will return to the READ line and produce the code OUT OF DATA. When there are several DATA lines they will all have to be checked, because the piece of DATA you have omitted was not necessarily the last.

In some cases the computer will follow the program correctly, without producing an error code, but from the programmer's point of view the program contains an error. In that case BREAK into the program at the moment it goes wrong. That will produce report code 9 and the line on which you have STOPped the program. That method makes it easy to locate the area of the program which contains the error.

Programs which you copy from magazines, books or from friends can be difficult to error-trap because they contain programming techniques which you have not yet learned, or simply because it is often difficult to follow another programmer's logic.

The flashing "S" or "?" indicating a syntax error may appear frequently. In that case check carefully what you have copied. You may not have recognised words such as LN or EXP as keywords.

On the ZX-81 especially it is easy to forget that pressing "π" will produce the word PI.

Make sure that when the "is not equal" sign, "<>" appears in a listing you always enter it as one character and not as "is less than", "<" followed by "is greater than", ">".

Technical problems can also cause errors in programs. Any alteration to the power supply can cause a program to CRASH. In that case the screen display may change dramatically and using the keyboard will have no effect. The only solution is to unplug your computer and begin again, making sure that your power supply and RAM pack are both connected firmly. That error is caused by the computer and not by the program.

'The error need not be on the line which produces the report; that is simply the line where the computer meets the problem'

Sometimes a program listing in a book or magazine will contain what seems to be a very obvious error. If it contains key words or symbols which are not on your computer, check that it is intended for your machine. Programs for the Spectrum, the ZX-81 and the ZX-80 are not usually directly interchangeable. If a program contains the command GOTO or GOSUB — a non-existent line number — the computer will simply go to the next numbered line after that one. That is a sign that a program has been developed and improved and is rarely an error.

When you have errors in a program, first check the report codes listed in Appendix B of the manual. It may then be necessary to read the appropriate section of the manual. Remember that the error is not necessarily on the line which produces the report code; that is simply the line where the computer meets the problem for the first time.

Always check carefully every line connected with the line containing the error code and the mistake should be easy to locate.


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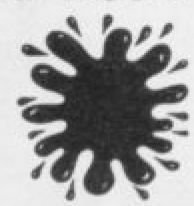
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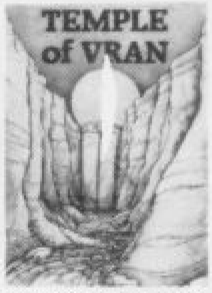
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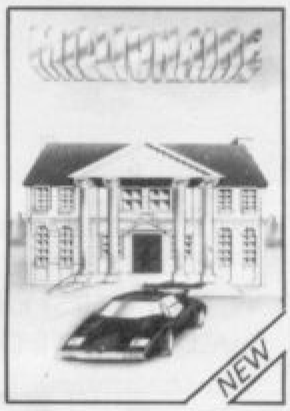
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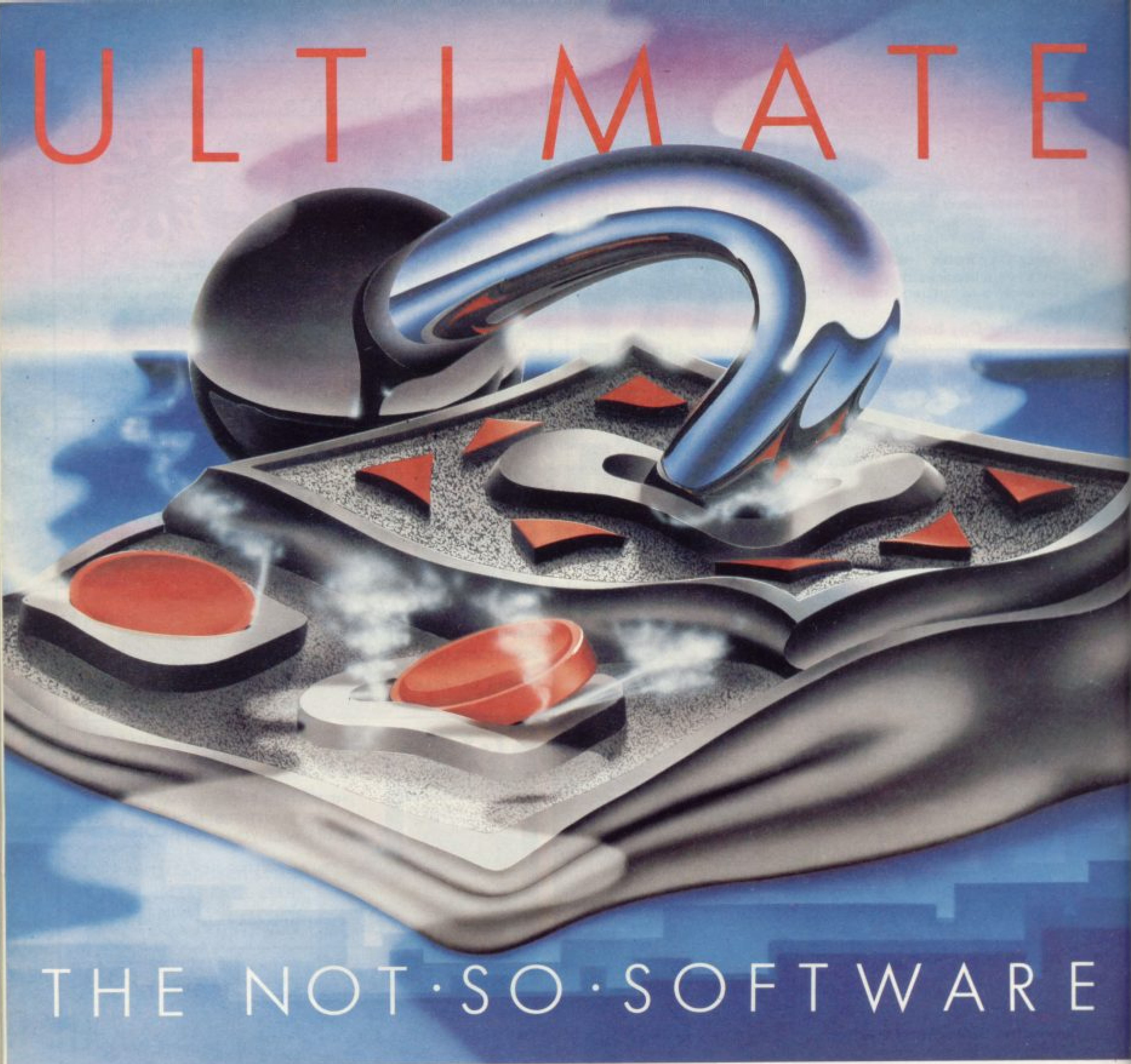
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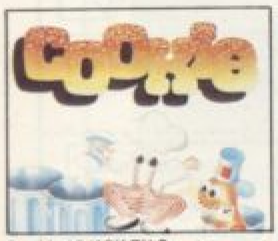
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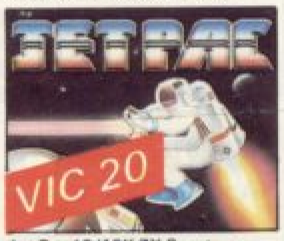
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SINCLAIR BUSINESS USER

Q Save trouble in the system

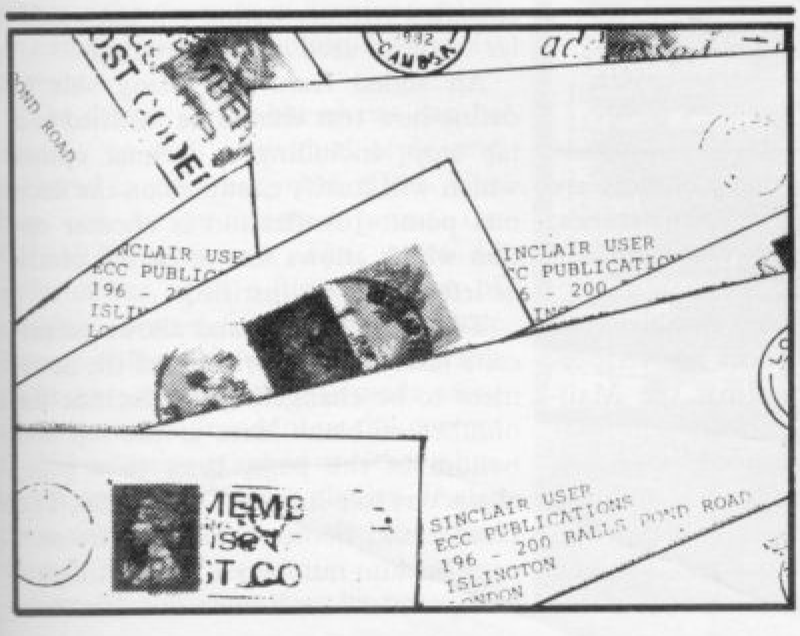
I HAVE BEEN using the following set-up for some time: a ZX-81 housed in a dK-Tronics keyboard, Sinclair 16K RAM, Q Save, Memotech Centronics Interface and Seikosha GP-100A Printer. Recently a Memopack 64K RAM was purchased. That has five switchable modes, only four of which are usable on the ZX-81. The problem is that there appears to be incompatibility between the Q Save, the 64K RAM and the Centronics Interface.

The following occur in the four modes: Mode B—Q Save Software will load successfully; after setting Q Save above RAM top—new, new line—and entering PRINT USR 8671 the computer responds with '32' in the top left-hand corner of the screen. Mode C—Q Save software will load successfully; the program will load successfully, but the printer will not operate. Mode D—As Mode B. Mode E—As Mode C.

Is there another RAM pack I can use, or can Q Save be modified so that it is usable? I have, incidentally, written to Memotech, PSS Ltd and Radionics Supplies (who I believe make the hardware for PSS).

I can, of course, use my existing set-up without Q Save, but I am very reluctant to do that. One program we are using in the office is a filing system using The Fast One from Campbell Systems—a very good program—but with the amount of data we will be eventually using, we cannot possibly use the conventional loading system—it would take far too long. With a program of that length Q Save really comes into its own.

J P Heritage,
General Manager,
The Triton Engineering Co. Ltd,



Masterfile update wins high praise

I BOUGHT a copy of Masterfile after reading your review in the February issue. I am more than enthusiastic about this terrific program, which makes it unnecessary to buy any additional programs for mailing lists, stock control, accounts and a whole host of other business uses.

This is to let your readers know that the new version 9 has an excellent printed manual and several very useful updates, e.g., back viewing of records and a supplementary program which converts the file for use with Microdrive.

In addition, when I telephoned the company regarding one or two queries, my problems were answered fully and clearly by the programmer.

Your business reviews are most helpful to me in making a decision about the suitability or otherwise of programs available.

B Stern,
Hayes,
Middlesex.

Vu-File on microdrive: Psion say no

WHAT a contrast. On receiving my Interface 1 and Microdrives I wrote to Tasman Software and Psion for guidance on using Tasword II and Vu-File respectively with Microdrive.

Tasman sent detailed instructions by return of post, Psion sent a stuffy letter full of claptrap about breach of copyright and said it was impossible. Long semi-business programs like Vu-File must be available on Microdrive. If Psion will not do it it is inviting cowboys to step in.

John Hurdley,
Birmingham.

Sweet shop cash book

AS THE OWNER of a 48K Spectrum I am interested in the computer for business use. I would like to know where I can obtain programs suitable for use with a small confectionery and stationery business. I use the Simplex D cash book, published by George Vyner Ltd.

I understand that Vyner has a program for use with Commodore 64 but not for use with any other computer.

S Allott,
Billingham,
Cleveland.

Quantum Leap to big business

The Psion software packages for the new QL are extremely powerful. Mike Wright investigates their potential uses

IN JANUARY, Sir Clive Sinclair launched his latest computer, the QL — it stands for Quantum Leap, not as some would have us believe Queue Long. Following the Spectrum and ZX-81 it is a major step forward in price and performance. Its features include a full keyboard, 128K RAM expandable by a further 512K, two Microdrives, TV or monitor outputs, a RS232 port, joystick ports, networking and multi-tasking.

The majority of business machines usually include some or all of the basic business programs — word processor, database, spreadsheet and graphics — in the price. The QL, although not specified as a business machine, has all of those included in its £399 price. The programs are Quill, a word processor; Abacus, a spreadsheet; Archive, a database; and Easel, a business graphics package. They are being written by Psion, creator of Flight Simulation and Chequered Flag.

The keywords in the design have been user-friendliness and flexibility, words which in programming terms are usually not synonymous. Work began on the suite of programs 18 months ago before the approach from Sinclair Research and it is intended to continue with updates and developments released from time to time via QLUB, the QL Users' Bureau.

The display is similar in all the programs and consists of a control area at the top of the screen which shows the commands and options available to the user; the display area which displays the output of the program; all the programs except Archive also have a status area at the bottom of the screen which shows information on items such as file name, amount of memory used or remaining, and mode of operation.

All the programs have a Help function which will give information on-screen of the options available. It is available at any time by pressing key F1. The Help pages are stored on the Microdrive cartridge and loaded only when needed. Other common features include the use of F2 to toggle the display of the control area on and off, F3 to select a command and ESC to back out of or escape from a situation.

While it is difficult to give more than a flavour of each program, I believe it will be sufficient to show some of the power of these excellent programs. When the QL was launched I was wildly enthusiastic about the software. Since then I have had the opportunity, thanks to Psion, of using it regularly and while I may have found the odd wrinkle or the occasion where a program does not behave exactly as I expected or hoped, that has not detracted from my exuberance. If anything I now look forward even more to the day when I have a QL. When the programs are released eventually for other machines, dBase II, VisiCalc and Wordstar will have real competition.

> 'The keywords in the design have been user-friendliness and flexibility, words which in programming terms are usually not synonymous'

Quill is a powerful and flexible word processor, although it does not yet possess the extra facilities that the Mailmerge and Spellstar programs provide for the popular Wordstar. It is easy to start with Quill and no computing knowledge is necessary; text is typed-in straight from the keyboard and is shown on the screen in exactly the way it will be printed. The program returns automatically to a new line at the end of an old one and it will move with it any word unfinished automatically.

Basic editing is just as easy. The cursor is moved via the arrow keys to the point to be edited and CTRL and either the left or right arrow key deletes letters to the left or right. For bigger amounts of text CTRL and ↑ deletes all text to the left while CTRL ↓ deletes text to the right. Text to be added is typed straight in; when the cursor is in position the text is re-justified automatically and if a large number of letters is added, two blank lines are inserted to save the constant shuffling of text.

Options are also provided so that bold type, underlining, and sub- or super-script can be used and seen as the text is being entered. That is done using the TYPEFACE option and bold type is denoted on-screen by using green lettering instead of the usual white.

More detailed editing and design work can be done using the COMMANDS. A list of them is provided by pressing the F3 key; a second list can then be obtained using the Other option. Each command is selected by pressing its initial letter when it is shown in the control area. They include options for searching and replacing specified strings, setting tab stops similar to those used on a typewriter.

An added feature is being able to define how text should be justified at a tab stop, including a decimal option which will justify numbers on the decimal point. Justification is another option which allows text to be left centre or left- and right-justified.

The Design command allows parameters related to the printing of the document to be changed. They include the number of blank lines at the top and bottom of the page, lines to a page, characters to a line — 40, 64 or 80. The Header and Footer commands let each page be auto-numbered in either alphabetic, numeric or Roman numeric char-

acters, as well as including text at the top — or bottom. Margin changes the start-up values for the three margins left (0), indent (10) and right (80).

Perhaps the most important feature for the serious business user is the ability to import files from the other three packages directly into Quill. That means that tables can be inserted directly into a report with the minimum of effort. Unfortunately graphs must be printed separately or photographed.

Graphs are a useful tool for illustrating points which need to be made. Often, unfortunately, they are not drawn because of the time and effort involved in obtaining a smart, clear display. With Quill, that is no longer a problem; even the chore of entering the data into a data file before plotting has been eliminated.

Once loaded, Quill shows the outline of the graph in the display area; the x axis is labelled January to December and the y axis is numbered 0-10. As numbers are entered they are displayed automatically on the graph, which is self-scaling to make most use of the room available. The labels along with any other text can be edited using the EDIT command.

Once one set of figures has been entered, another set can be entered using the NEWDATA command. A name for the data is requested but before apparently returning to the start the old set is stored in memory. Any old set can be used as the current figure by the OLDDATA command.

It is also possible to create a new set of data by using a formula. For example, wave=sin — count *10*PI()/180 creates and displays as a bar chart a set of figures called wave which is calculated as the sine of count, a variable which returns 1 for the left-most figure, 2 for the next, and so on; times 10 times the constant pi divided by 180 or simply a sine wave plotted every 10 degrees.

The design of the bar charts can be changed to suit individual style and taste and to give maximum effect. The bars can be re-designed using the CHANGE command. That gives 17 styles of bar, with a further option of creating user-defined bars. More changes to the style and colour of graph paper, axes and text are also made using that command. In addition the current figures can be re-graphed as either a line graph or pie chart using change. It also gives similar options on the style and colouring of the graphs.

Even on a graph it may be necessary to pick out a particular value to emphasise it. A HIGHLIGHT command has been provided for that purpose. It allows a special symbol or bar to be used to represent the data point in line and bar graphs but perhaps it is most useful on pie charts, where the sector is highlighted by being detached slightly from the rest of the pie.

More than one set of data can be shown at once using the VIEW command. That suggests that all data sets should be displayed but allows the user

'Cells can also be defined by the appropriate row and column levels'

to name only those he wants to be shown. It then offers a format for the display or users can select the format.

Data can be transferred to Abacus, Archive and Quill by the EXPORT command. When a graph is sent to Quill it is sent as a table of values. Reproduction of the graph for use in a document must be done using PRINT or by photographing the screen after the control and status areas have been cleared using key F2 and shift F2 respectively.

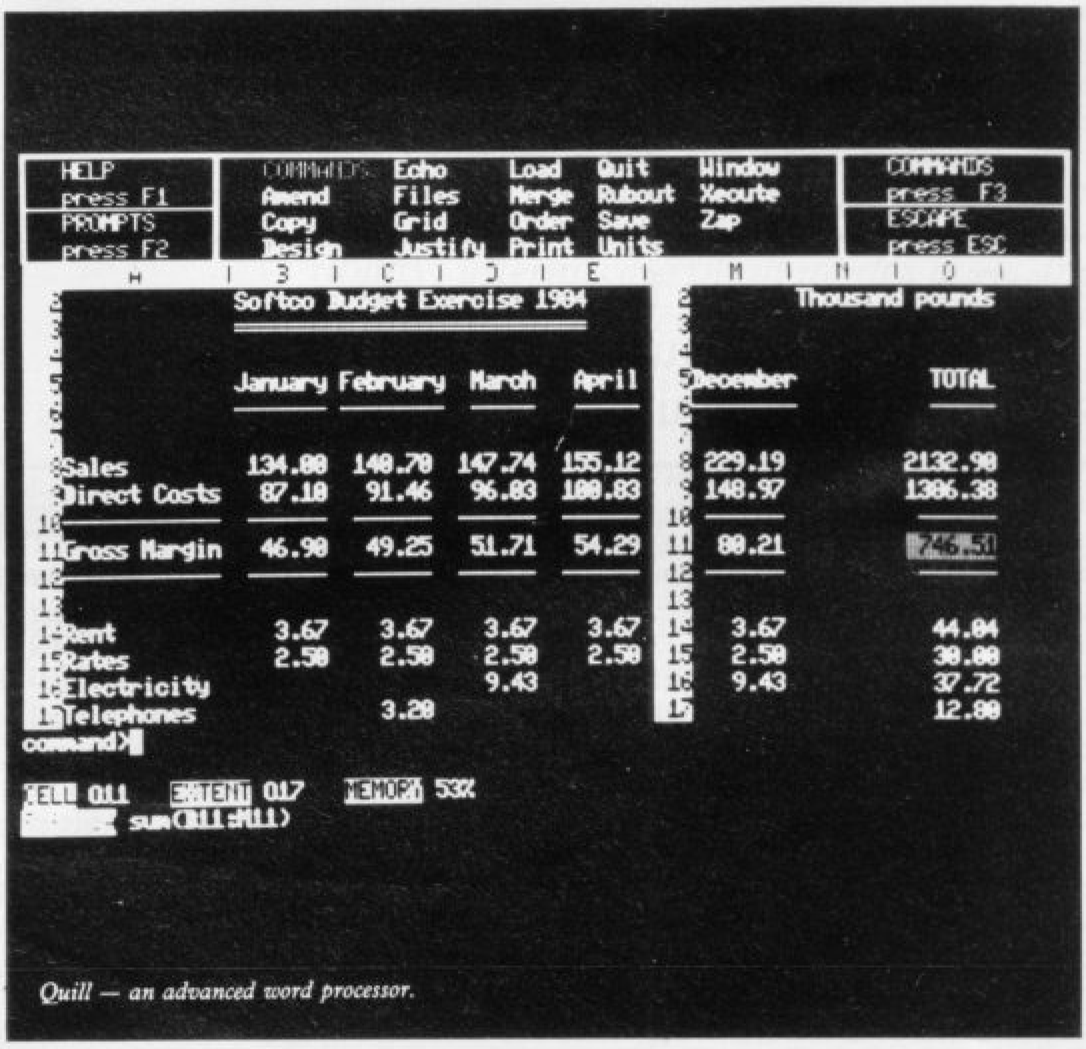
Abacus is described as a thinking spreadsheet. Psion has used the term to try to describe the impressive features it contains. The spreadsheet mimics a large piece of paper, in this case with 256 rows and 64 columns — only a window of 16 rows and seven columns is shown on screen. Each cell on the sheet is referred to by a column — letter(s) — and a row number — e.g., A1, B16, BL256 — and can contain a number, text or a formula.

Numbers can be shown on the spreadsheet in five ways — Integer, Decimal, Exponent, Monetary and Percent. Decimal, Exponent and Percent all allow the number of decimal places to be specified, while Monetary rounds to two decimal places and inserts a leading user-specifiable currency sign.

Perhaps one of the most powerful features of Abacus is its ability to label rows and columns and to use those labels in further calculation. Cells can also be defined by the appropriate row and column labels. Formulae can be defined for a cell, row, column or even a range of cells.

A range of commands allows the user to amend data on the sheet, copy cells or blocks to another position, echo the number or formula in one cell to another cell or range of cells or erase the contents of one or more cells. A column of numbers can be sorted using Order;

continued on page 112



Quill — an advanced word processor.

continued from page 111

although the numbers are affected, formulae are not. Grid allows rows or columns to be inserted or deleted.

Other commands allow the user a high degree of design flexibility. Numbers and text can be left centre or right-justified using JUSTIFY. The DESIGN command offers options on Auto-calculation — the table is re-calculated after every entry. If Auto-calculation is turned off, a re-calculation can be forced by the XECUTE command, treating cells with zero as noughts or BLANKS, the order of calculation — rows or columns first — and a range of options on controlling the printer.

Two sections of the sheet can be shown together with the WINDOW command. A range of options is provided for handling files, including merging one grid with another, loading, saving, importing and exporting.

While the range and ability of the commands is impressive, the range of functions Abacus supports almost turns it into a programming language. Apart from the usual arithmetic functions, the user can be prompted for input, as either text or numeric, by using the ASKT or ASKN in a cell.

Other functions depend on the QL clock being set and the return date, time or number of days passed since a nominal zero value or the name of month (n) where n=1-12. For the financial user a Nett Present Value and an Internal rate of Return function are provided. A look-up table can be set up elsewhere in the grid and referred to.

As one would expect with such a range of commands and functions, there is a wide range of error messages which help to locate easily any mistakes which may have been made or may arise from calculating a formula with a meaningless argument.

The fourth and most complex program of the Psion package is Archive, a multi-file relational database. As such it has its own language with a syntax similar to QL SuperBASIC. Programs can be written as a series of self-standing routines, called procedures, which will be familiar to BBC micro owners but probably not to ZX-81 or Spectrum owners.

The basis of any database is Fields, Records and Files. A field is the basic piece of information, e.g., name; a record is a group of fields and the file is a group of records. A file is started by using the CREATE command and also specifying the variable names which will make up the fields.

Records can be added to a file by the INSERT or APPEND commands, though it will usually be easier to use Insert which prompts for the variable names. While the DELETE command erases a record from the file, it erases only the current record and so will often be used in conjunction with the BACK and NEXT commands.

Back displays and makes current the previous record while Next does the same for the next record. The FIRST and LAST commands perform a similar function, displaying the first and last records respectively, and POSITION sets the record with the number specified the current one. Once a file and all its records have been created they can be saved by closing it with CLOSE or QUIT. When at a later stage the file is to be used it must be opened i.e., loaded into memory and made ready for use. Archive files can be used in two ways, as read-and-write files or read-only files. When files are opened so that they can only be read the LOCK command is used, while OPEN is used to open read-and-write files.

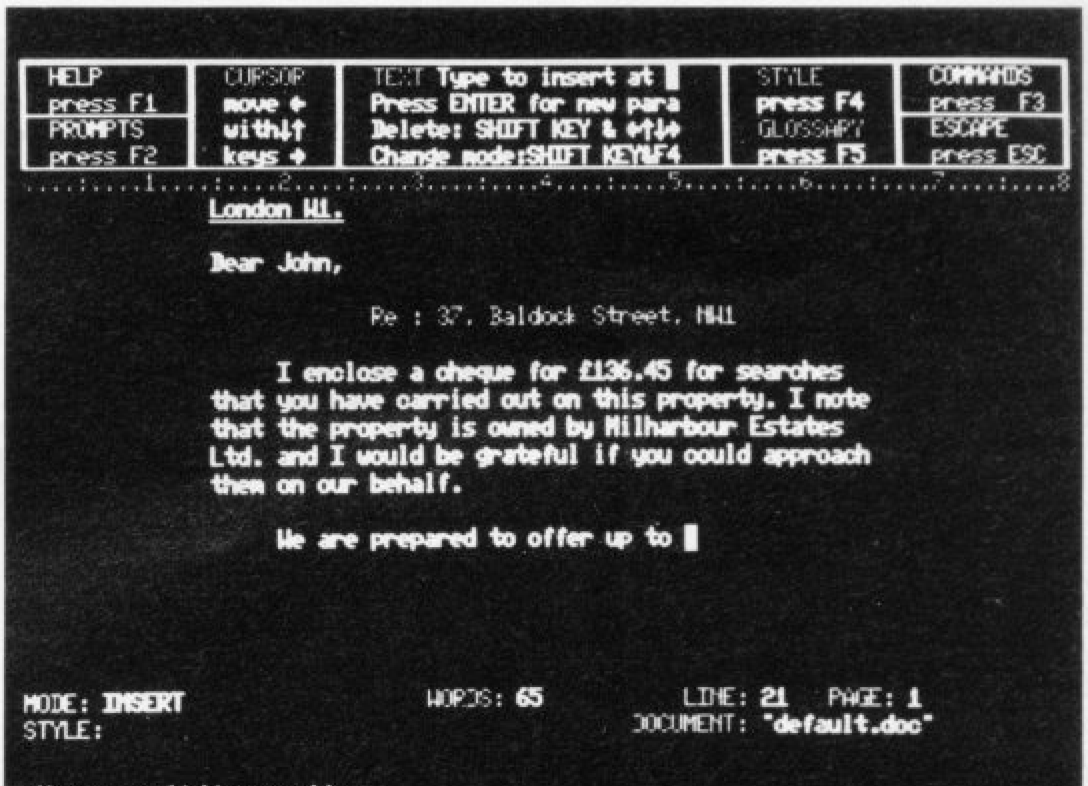
Records and fields can all be searched using the FIND and SEARCH commands. Find looks through all fields for a given string, independent of capitals, and the first record with the field is shown. Others can be displayed using Continue. Search is more selective and searches the named field(s) for the string, as specified. Again the first matching record is shown; others can be shown using continue. SELECT picks out a subset of the records.

Archive has an in-built format for records but that can be changed to the users' own using the SEDIT command. That can then be saved using SAVE and re-loaded using SLOAD. Once loaded, the display becomes active and is used for displaying records in that format.

Procedures are written using the EDIT command and are named programs without numbers, written using the commands of Archive. The full command set includes loops — while: endwhile; branching — if: endif; user input — input. A range of functions is also supported. Procedures can also be created using the other procedures. It is conceivable that a procedure could consist of other procedures.

In the Edit command, facilities exist for deleting and re-positioning commands as well as inserting or amending them. A Trace mode is also provided so that a procedure can be followed line by line to speed up the location of errors.

● *Mike Wright is currently writing a series of books on the QL software for Melbourne House.*



Abacus — a thinking spreadsheet

'Programs can be written as a series of self-standing routines, called procedures, which will be familiar to BBC micro owners'

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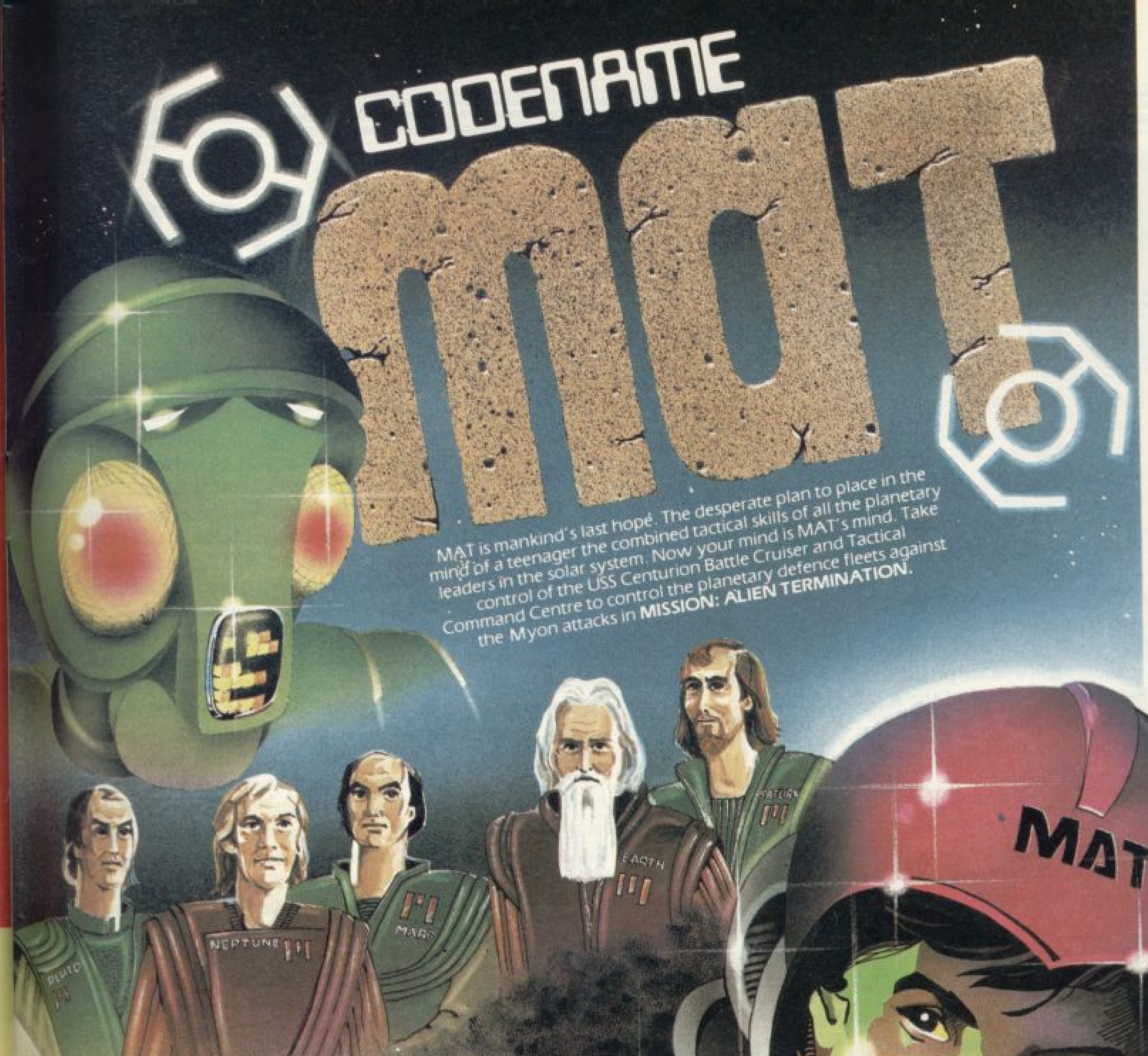
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Great expectations

Theo Wood talks to teachers about the potential of computers in education and finds the possibilities fascinating

THIS is likely to be the year when the educational uses of the computer move to the forefront of discussions among teachers in schools, both primary and secondary. One development to note is the way teachers have taken different routes to become adept at using a computer in the classroom. Some may have attended courses provided by their local education authorities, while others, having bought micros for home use, have taken them into schools and been surprised by the overwhelming popularity of the micro in their own teaching situations.

Steve Wright, who teaches at Langdon School, a comprehensive in the London Borough of Newham, already had a great deal of computing experience before he began using a Spectrum in the mathematics department. While working for his physics degree he used a mainframe and during post-graduate work was writing programs in Fortran. Buying a ZX-81 rekindled his interest in programming and he started writing programs he could use in school work. When he bought a Spectrum the process continued and there are now three Spectrums in his department.

> ### 'A micro has a special effect on children'

Ken Heaton, a teacher at Gateway Junior School, Lisson Grove, London had used computers in his mathematics and statistics course at Kent University but it was buying a Spectrum which spurred him to become involved in using computers in the educational field. He first took his Spectrum for children to use in a lunch-time computer club. The response was overwhelming.

"The demand was so great that we had in the end to limit the numbers to the higher end of the school, because so many children were interested," he says.

Terry O'Brien, a teacher at Comber Grove Primary School, Camberwell, became enthusiastic about the potential of computers in schools when he attended two-day introductory course at the MEP centre in Croydon. After that he bought a Spectrum for home use and then started to use it at school, where there are now four Spectrums as well as one RML 480-Z.

Having introduced computers into schools, the most important consideration is how their use is to be implemented in everday learning. I spoke to Ian White, an advisory teacher for secondary education at the Inner London Educational Computing Centre. He sees the role of the computer as important in a number of areas.

"It has a very wide-ranging role. In my subject area you have the computer studies course which is taken to examination level, and that is a specialist study in computers. That in the past has tended to be the only computer education and has necessarily had to do computer awareness.

"There is the awareness of society in general and computers as part of that society has to be taught within that. Computers are used in particular subject areas to enhance those subjects."

Wright sees the computer as particularly useful in the latter field, where cross-fertilisation of work between the computer and other more conventional modes of studying is increasing motivation by the use of computer modelling and more learner-orientated discovery.

He is interested in the role which strategy games can play in the curriculum and has been using **Corn Cropper,** a Spectrum program, with his second- and third-year pupils to great effect.

As a teacher at junior school level, Heaton summed up his view of the role a computer can play. "I think in an infant and primary school it is important to grow with the times, so that children are used to a computer from the age of four or five, so that once they go to secondary school, it is not a complete shock to them."

For O'Brien, a computer has its place in the activity classroom, not only to help with basic skills but to introduce children to new areas of learning, such as Logo.

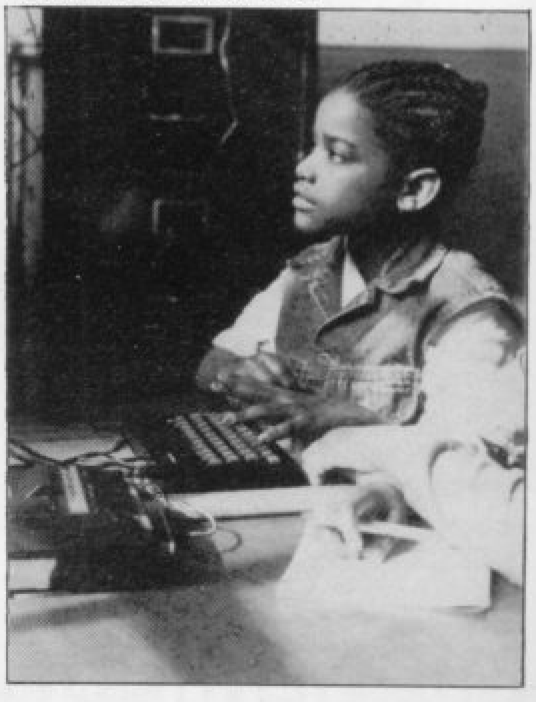
"A micro has a special effect on children as it is completely non-judgmental and allows them to acquire and reinforce basic skills in an efficient and enjoyable way".

Authorities vary as to which hardware to support in their schools. The Inner London Education Authority, for example, like many others, decided to standardise on the RML machines at primary and secondary level. There are obvious reasons for standardisation, as support systems can develop software and maintenance for all machines in the schools. Other authorities, such as Grampian Regional Council, chose to support the Spectrum at primary level.

Of 285 primary schools, more than 240 have ordered or have received their Spectrum kits under the Department of Trade and Industry scheme. Gavin Bell, director of the project at the teachers' resources centre in Aberdeen, says:

"We are conducting a survey on computers owned by schools but there are already clear signs that schools are buying more computers — several have four or five. One of the reasons for choosing the Spectrum was that, while the first computer is subsidised, second and subsequent machines are not. With bulk discounts our schools can buy a complete 48K kit, with printer, Microdrive and colour display for less than £400. In-service training is being carried out in stages and there is further support for teachers via regional working parties which are reviewing avail-

concentration at Comber Grove



able software, producing guidelines on the best use of various packages, and drawing up specifications for educational programs."

The relative merits of various pieces of hardware from a technician's point of view is best argued in other forums; teachers are more likely to be interested in what a computer can do in their own subject areas. Just as there are different decisions as to hardware, it would be very surprising if there was complete agreement about the merits of various approaches in software. The child-centred approach obviously favours programs which allow children to investigate, discover and create. At the other end the teacher-centred approach would prefer programs which have a clearly identifiable purpose within the scope of skills training.

Those are the two extremes of the axis and the two views are not mutually exclusive, in that an open-ended program such as Logo can be teacher-directed, and some programs which reinforce basic skills by requiring text entry can be of the exploratory type. Teachers and parents will choose software from what is available, according to their proclivities for a certain approach, as well as recommendations from other teachers and teachers' centres. Some may even write their own programs as Wright, Heaton and O'Brien have done.

'The real power of computing will be seen in simulations'

There is a need to evaluate software beyond the review stage to discover if a particular program achieves results for a period, say six months. With his headmaster Michael Kent, O'Brien hopes to raise money so that every classroom in his school is provided with a Spectrum and eventually hopes that the school will become a centre for the evaluation of programs used on an everyday basis.

Commercial software has improved in the last year, he thinks: "A year and a half ago the experts were correct in saying they were rubbish but I think that is changing".

In the last year vast numbers of programs have been published for the Spectrum but there are still gaps, particularly in the number of information retrieval database packages, a proper implementation of Logo, and a junior word processing package. There could be many more strategy/adventure games which complement course work in various subject areas for children who have acquired basic skills.



Ken Heaton and Steve Wright

The Sinclair Education Exhibition held in March indicated that those gaps are about to be filled. The Sinclair Logo was on show, with intended release in about a month, and a half-finished junior word processor called Scribe, written by CSH Ltd of Cambridge, was also on the Sinclair stand.

I asked David Park, Sinclair educational representative, what software developments he would like to see in the future. "I am keen to see programs which develop logical thinking and those which employ the strengths of the computer in data handling. We would hate to see a number of drill and practice programs; they have their uses but that is not the way forward. The real power of computing will be seen in simulations, something children cannot experience in their local environment, such as simulations of real events, like running a coal mine or an oil field".

The most impressive feature of the show was the control applications for the Spectrum. Griffin and George, supplier to schools was showing its interface which provides three types of inputs and three outputs. Applications on show included a Fischer-Technic model with full moving gears, a robotic arm and a panda crossing. Griffin and George supplies all the accessories, such as stepper motors and sensors to measure temperature, pressure, magnetic fields and movement.

Richard Bignall from the MEP project for the Chiltern area spoke of future developments for the Spectrum: "The developments in which we are involved are using Logo for control applications in the primary school, so that instead of just doing Turtle graphics for driving a turtle on the floor, you can plug in other pieces of hardware.

"We are hoping to produce in the next year a self-contained board for primary schools which will allow them to interface with the real world and to demonstrate certain principles, such as digital and analogue input/output. It will be expandable.

"We have been using versions of Basic in secondary schools for control applications and are working on a version of control Basic for the Spectrum.

"Looking at Logo, we hope to do the same thing in a much more friendly fashion; in fact, we are very tempted to say let us use Logo for most applications. We are aiming for an A4-sized board costing around £100, not in a box, as we want the children to see the circuits and get away from the black box image.

"The board will run two motors with reversing of the Lego type. There are plenty of remote-controlled children's toys on the end of a piece of wire which range from the talking dog to such things as racing cars, as well as model trains."

With all those developments, it looks as if the role of the Spectrum as an education machine is assured. Interfacing projects will soon be within the scope of children and adults who may have had no previous experience of electronics and, apart from the benefits to technical education, the developments look like being enjoyable and, above all, entertaining.



48K ZX SPECTRUM
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This is 'ZIGGY', shown above, in his exploratory capsule and is a true representation of the on-screen graphics.

THE PYRAMID

THE PYRAMID is an arcade style game which has a very adventurous feel to it.

The Pyramid contains 120 chambers on 15 levels. In order to get from one chamber to another you must fight off the indigenous aliens to collect an energised crystal which will neutralize the force field guarding the two exits.

The Pyramid is inhabited by a total of 60 weird and exotic alien types, all of which are beautifully animated. You will meet a whole variety of demons, droids, insects and monsters, with a sprinkling of the more unusual, the extra-terrestrial tweezers, galactic strawberry, cosmic claw, mutant eye, plus a whole host of entities that defy rational description. You'll no doubt invent your own nicknames.

You proceed to explore the pyramid from top to bottom with the difficulty generally increasing with the depth of level. Depending on the choice of exit from each chamber you are likely to have a different game every time you play.

Apart from the challenge of trying to achieve the highest score possible the pyramid contains a number puzzle to solve. The more chambers you successfully visit the more information is gathered to enable you to discover the secret numbers of the pyramid. The puzzle won't take you days to solve, it will probably take you a few months.

DOOMSDAY CASTLE

DOOMSDAY CASTLE consists of a labyrinth of 74 complexly interconnected Halls and Passages where you will meet a whole host of adversaries serving the infinitely evil Scarthax, the Garthrogs, the Orphacs, the phenomenally nasty Googly Bird and the Urks which manifest themselves in over fifty unbelievably weird and wonderful guises.

Scarthax has scoured the Universe to bring together the six ancient stones of lifeforce. United in Doomsday Castle they are being used to wield an irresistable power over the cosmos, emanating waves of corruption through every galaxy.

To save the Universe, you must battle your way through the Castle to find and collect the six stones and use their force against Scarthax to destroy Doomsday Castle, hopefully escaping yourself before the final cataclysmic explosion.

The task is not easy (saving the Universe never is!) and it will take you many games to unfold the structure of Doomsday Castle and discover the locations of the ancient stones.

The addictive arcade style action will keep you coming back to play but the overall challenge should still keep you occupied for months.

FANTASY SOFTWARE is available from W.H.SMITHS, JOHN MENZIES, BOOTS, LASKYS, GREENS, RUMBELOWS, SPECTRUM GROUP, COMPUTERS FOR ALL and all other good software retailers.

The Pyramid at £5.50 and Doomsday Castle at £6.50 from

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...Were conjured the ghouls, ghosts and outraged spirits of centuries of sacrifices to the occult. Hurled forth from who-knew-whence to thwart your escape down the perilous fortress steps. An ill-timed move will plunge you into his waiting spider's tangled web. 12 levels of haunting action.
Spectrum
NEW
Spellbound
Spells
NEW
The War of the Solstice will commence!
the Lords of Midnight
Gather those you can to your banner. The World's first Epic game. Not an adventure but a living fantasy novel. And you are the author of the action.
Spectrum



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The trouble with joysticks

Andrew Hewson answers add-on queries

IT IS inevitable, I suppose, that as more add-on hardware reaches the market, more people should write to me concerning their difficulties in running all the items in their collection at one time. When the Spectrum was released the only available add-on was the ZX printer. These days a cursory glance through the pages of this magazine will reveal the variety of items available to the willing purchaser — keyboards, sound units, speech units, light pens, joysticks and more joysticks, printer interfaces, to say nothing of the official Sinclair Interfaces One and Two.

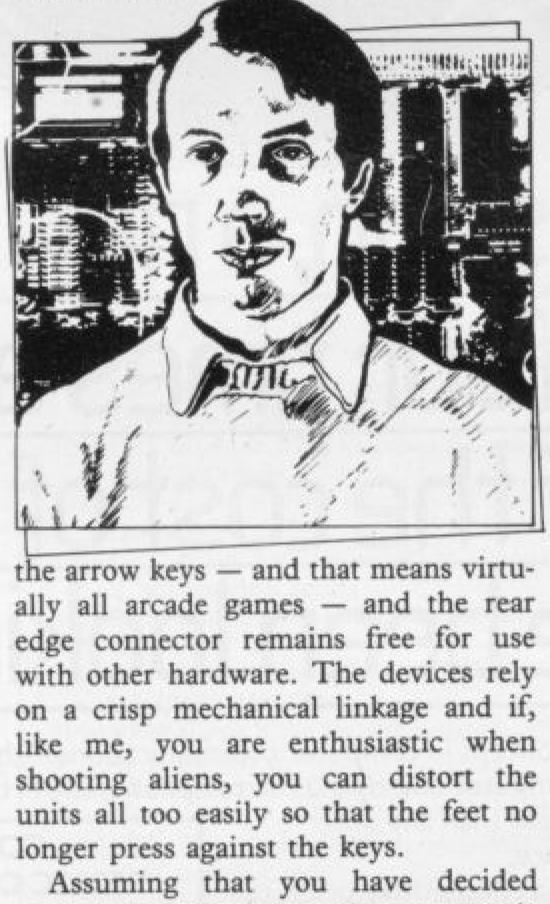
The main difficulty people experience is plugging all the items in their collection into the back of their machines at the same time. Sometimes the difficulty is physical, in that the bulk of one item prevents a second item being plugged in, but too often it is because a manufacturer has omitted to provide a duplicate edge connector on the rear of the equipment, thus preventing a second or third item from riding piggyback. That seems particularly thoughtless to me.

In principle, the problem can be solved by an hour or so of careful work with a soldering iron, some edge connectors and suitable multi-way cable, but I doubt if most people care to be so adventurous. In view of the multiplicity of add-ons, my advice is that if it does not have a second edge connector, don't buy it. In the last resort, consult the small advertisements as there are some constructive firms supplying extension systems.

The main topic this month is joysticks. I have had a number of letters about them, including this cautious enquiry from Grahame Cox of Epsom. He writes: **I have not bought a joystick because the number of options is bewildering. Would you please advise me what are the advantages and disadvantages of the various arrangements?**

The choice is bewildering, as he says, but probably the simplest arrangement is the keyboard clip-on type such as the Mechanical Stick from EEC or the Spectrum Stick from Grant Design. Those devices clip over the upper face of the Spectrum and contain plastic linkages which transmit the physical movement of a short joystick via appropriately-positioned feet direct to the arrow keys — 5, 6, 7 and 8.

That arrangement has three advantages. It is cheap, it is guaranteed to work with all the games which also use



the arrow keys — and that means virtually all arcade games — and the rear edge connector remains free for use with other hardware. The devices rely on a crisp mechanical linkage and if, like me, you are enthusiastic when shooting aliens, you can distort the units all too easily so that the feet no longer press against the keys.

Assuming that you have decided against the clip-on type, the next step is to realise that there is a difference between the joystick and the electronic box of tricks — the interface — which connects the joystick to the computer. The joystick proper is essentially a stick with a limited degree of movement which closes one or more of a group of microswitches as the stick is moved within a frame.

For my money there is not much to choose between the various conventional makes, although some people have strong preferences. I find the stiffer ones with a strong tendency to self-centre easiest to control but that is probably because I like to wrestle with the stupid things. The Trickstick from East London Robotics is a novel idea and perhaps it points to the kind of finger-tip control which will become common in the future.

The greatest variation between manufacturers occurs in the interfaces. There are four types. Kempston, so-called because Kempston was the first in the market to use the system — the joystick setting is returned by the IN 31 command; arrow keys — The joystick mimics the arrows keys 5 to 8 and the fire button mimics the 0 key; Sinclair interface two — the right-hand joystick mimics the top right half row — keys 6 to 0 — and the left-hand joystick mimics the top left half row — keys 1 to 5; programmable — can be set to mimic any five keys on the keyboard.

Logically, the programmable types should be recommended because they are the most flexible but re-setting them can be a tiresome business. The arrow-key types make a good second best, because so many games use those keys. A number of games also use the Kempston system because that was the first joystick on the market. The company also markets a range of conversion tapes for a number of popular games. I would put the Sinclair arrangement last in order of preference although, as the company manufactures the computer, I suppose we must permit a certain leeway.

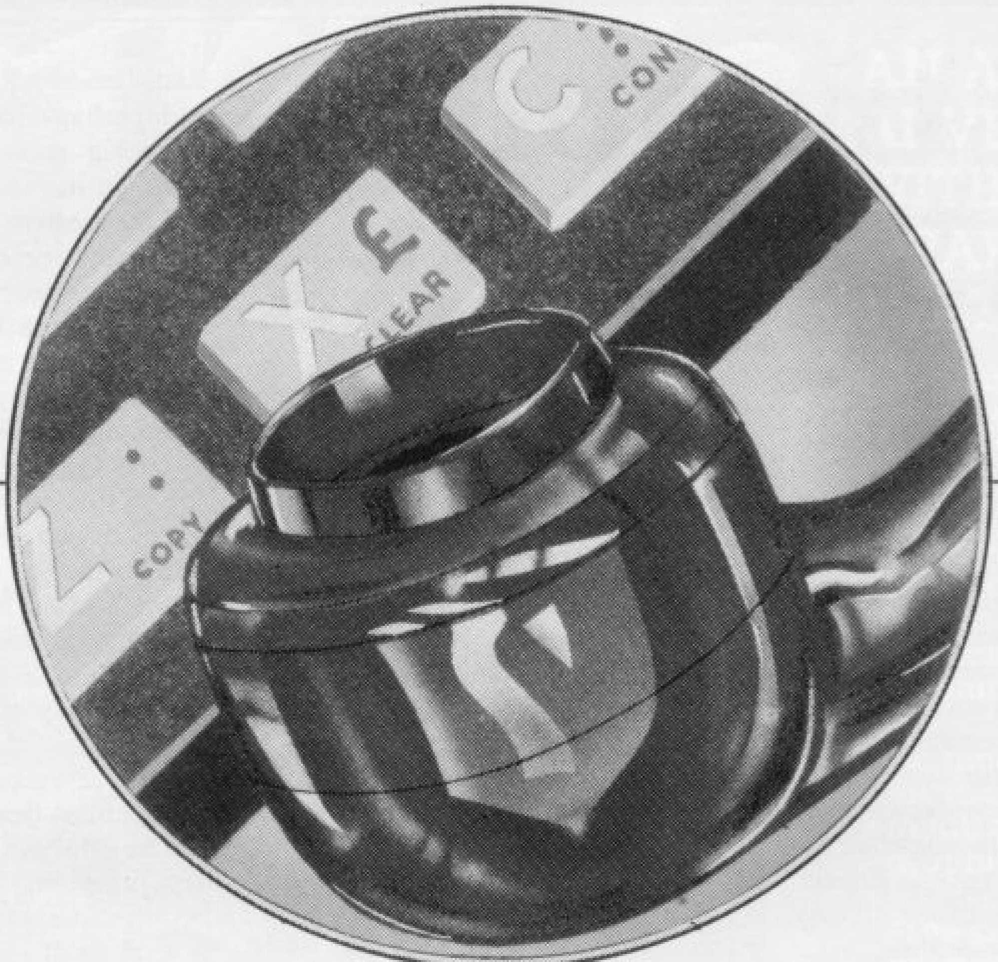
Andrew Church of Gainsborough raises a common query. He writes: **Last Christmas I was given a Quickshot joystick but many of the games I had acquired previously are not compatible. Can I convert them?** Derek Ward of Abingdon has a similar problem with his Interface Two and Crack Shot joystick.

In principle any game can be converted provided you are able to "break" it so as to be able to analyse the program. If the joystick is read in machine code,

> 'There is not much to choose between the various makes'

you must disassemble the program and locate the IN instructions. Study page 160 of *ZX Spectrum Basic Programming* to determine the substitutions to be made to make the program compatible with your interface. If the joystick is read in Basic, make the appropriate substitutions in each INKEY$ or IN instruction.

continued on page 127





● *Please address problems and queries to Andrew Hewson, Helpline, Graham Close, Blewbury, Oxfordshire.*

continued from page 125

Mike Harding of Derby raises an interesting point for discussion. He writes: **I have noticed a great variation in the sophistication of the joystick control in various games on the market. Some are restricted to movement in one of four directions at right angles. In some, diagonal movement can occur and in some movement is possible in any direction. I have tried to emulate those effects in my software but I have not gone very far.**

When I received that letter I turned to my colleague, Steve Turner, author of **3D Lunattack** and other games, because he has made a study of joystick control features in the course of his work. This explanation is based on his comments. The initial problem is to achieve a balance between human reaction times and the speed of the game. If a single speed increment is used, so that for example moving the joystick to the left causes an object to move to the left at a constant speed, moving the joystick instantaneously to the right halts the object and moving the stick to the right again starts it moving to the right at a constant speed; the net result is a rigid, inflexible game with not much "feel".

Turner's solution is to read the position of the joystick as frequently as possible and to adjust the velocity of the object on the screen by a small amount in accordance with the current joystick position. When that technique is used, an object appears to accelerate gradually from rest to a maximum velocity in a given direction.

The rate of acceleration and the maximum velocity can be "tuned" by the programmer to make the game challenging to play without being impossible. It is also possible to include a decay constant so that the object slows gradually if the joystick is returned to the central position.

An additional feature of Turner's approach is that while it is necessary to read the joystick only in four directions at right angles, the object can be driven in any direction on the screen. Inspired by his comments, I had the Spectrum program listed in table one written to demonstrate the effects. The program can be adapted for use with either the Interface Two — lines 2000 to 2060 — or the arrow keys/keyboard clip-on type — lines 5000 to 5070. Notice how the IN command is used to read the hardware in each case.

The program includes two constants, CC1 and CC2, set in lines 1045 and 1046, which control the "feel". The first one determines the increment in the movement of the object each time the joystick is read and the second determines the rate of decay to rest.

```
100 GO SUB 1000: REM Define variables,
    constants and functions
105 BRIGHT 1
115 REM Repeatedly . . .
120 GO SUB 5000: REM Check for joystick
    activation
130 GO SUB 3000: REM Do calculations
140 GO SUB 4000: REM Do display
150 GO TO 120
155 REM . . . until <BREAK> is pressed
1000 LET ax=0: LET ay=0: REM Horizon-
    tal and vertical acceleration
1005 LET ux=0: LET uy=0: REM Initial
    velocity
1010 LET vx=0: LET vy=0: REM Final
    velocity
1020 LET sx=128: LET sy=85: REM Hori-
    zontal and vertical position
1022 LET x=sx: LET y=sy: REM Plot co-
    ords
1030 LET axm=10: LET aym=10: REM
    Maximum acceleration
1035 LET vxm=30: LET vym=30: REM
    Maximum velocity
1040 LET sxm=255: LET sym=174; REM
    Maximum screen co-ords
1045 LET cc1=1.0: REM Constant for joys-
    tick effectiveness
1046 LET cc2=0.3: REM Constant for iner-
    tial decay
1055 LET wx=0: LET wy=o: REM 'True;
    if 'wrap-around' occurs
1060 REM Find the remainder after the div-
    ision a/b
1070 DEF FN m(a,b)=(ABS (a/b)—INT ABS
    (a/b))*ABS b*SGN a
1090 REM Check if the bit with weight b is
    set in number n
1100 REM Return 'true' flag if set, 'false' if
    clear
1110 DEF FN t(n,b)=(INT (n/b)/2—INT
    (INT (n/b)/2)<>0
1122 REM Limit the number n to the range a-
    b
1124 DEF FN x(n,a,b)=(n<a)*+(n>=a
    AND n<=b)*n
1130 REM Flags for the joystick functions
1140 LET left=0: LET right=0: LET
    fwd=0: LET back=0: LET fire=0
1160 LET value=0: REM Byte returned by
    joystick port
1180 LET bdr=7: REM Border colour
1200 INPUT "Would you like a trace (y/n)?
    ";a$
1202 IF a$<>"y" and a$<>"n" THEN
    GO TO 1200
1204 LET p=(a$="y")
1208 INPUT "Would you like values print-
    ed? "a$
1210 IF a$<>"y" AND a$<>"n" THEN
    GO TO 1208
1212 LET v=(a$="y")
1220 FOR i=0 to 255 STEP 10
1230 PLOT i,84: DRAW 0,4
1240 NEXT i
1260 FOR i=0 TO 169 STEP 10
1270 PLOT 127,i: DRAW 3,0
1280 NEXT i
1340 RETURN
1999 REM for a ZX Interface 2
2000 LET value=IN 61438
2020 LET left=FN t(value,16)=0
2030 LET right=FN t(value,2)=0
2040 LET fwd=FN t(value,4)=0
2050 LET back=FN t(value,8)=0
2060 LET fire=FN t(value,1)=0
2080 RETURN
2400 REM Diagnostic —
2410 REM 'RUN 2500' to test the INput
    routine
2500 GO SUB 2000: CLS: PRINT left,
    right,fwd,back,fire: GOTO 2500
3000 LET ax=FN x(ax+cc1*(right-left)-
    cc2*SGN ax,-axm,axm): REM Accelera-
    tions
3010 LET ay=FN x(ay+cc1*(fwd-back)-
    cc2*SGN ay,-aym,aym)
3030 LET vx=FN x(ux+ax,-vxm,vxm):
    REM Velocities
3035 LEY vy=FN x(uy+ay,-vym,vyn)
3050 LET sx=sx+ux+0.5*ax: REM Dis-
    placements
3055 LEY sy=sy+uy+0.5*ay
3070 LET w=(sx<0 OR sx>sxm OR sy<0
    OR sy>sym)
3075 IF w THEN LET sx=FN
    m(sxm+sx,sxm): LET sy=FN m(sym+
    sy,sym)
3100 LET ux=vx: LET uy=vy
3120 RETURN
4000 LET bdr=FN m(bdr+fire,8):BORDER
    bdr
4015 PLOT OVER 1;x,y
4020 IF p AND w=0 THEN DRAW sx-x,
    sy-y: GO TO 4030
4025 PLOT OVER 1;x,y
4030 LET x=sx: LET y=sy
4034 IF v=0 THEN GO TO 4050
4035 PRINT AT 0,0;"                                "
4036 PRINT AT 1,0;"                                "
4037 PRINT AT 2,0;"                                "
4038 PRINT AT 0,0;INT ax,INT ay ' vx,vy '
    sx,sy
4050 RETURN
4999 REM Keyboard clip-on
5000 LET value=IN 63486
5010 LET left=FN t(value,16)=0
5030 LET value=IN 61438
5040 LET right=FN t(value,4)=0
5050 LET fwd=FN t(value,8)=0
5060 LET back=FN t(value,16)=0
5070 LET fire=FN t(value,1)=0
5090 RETURN
```

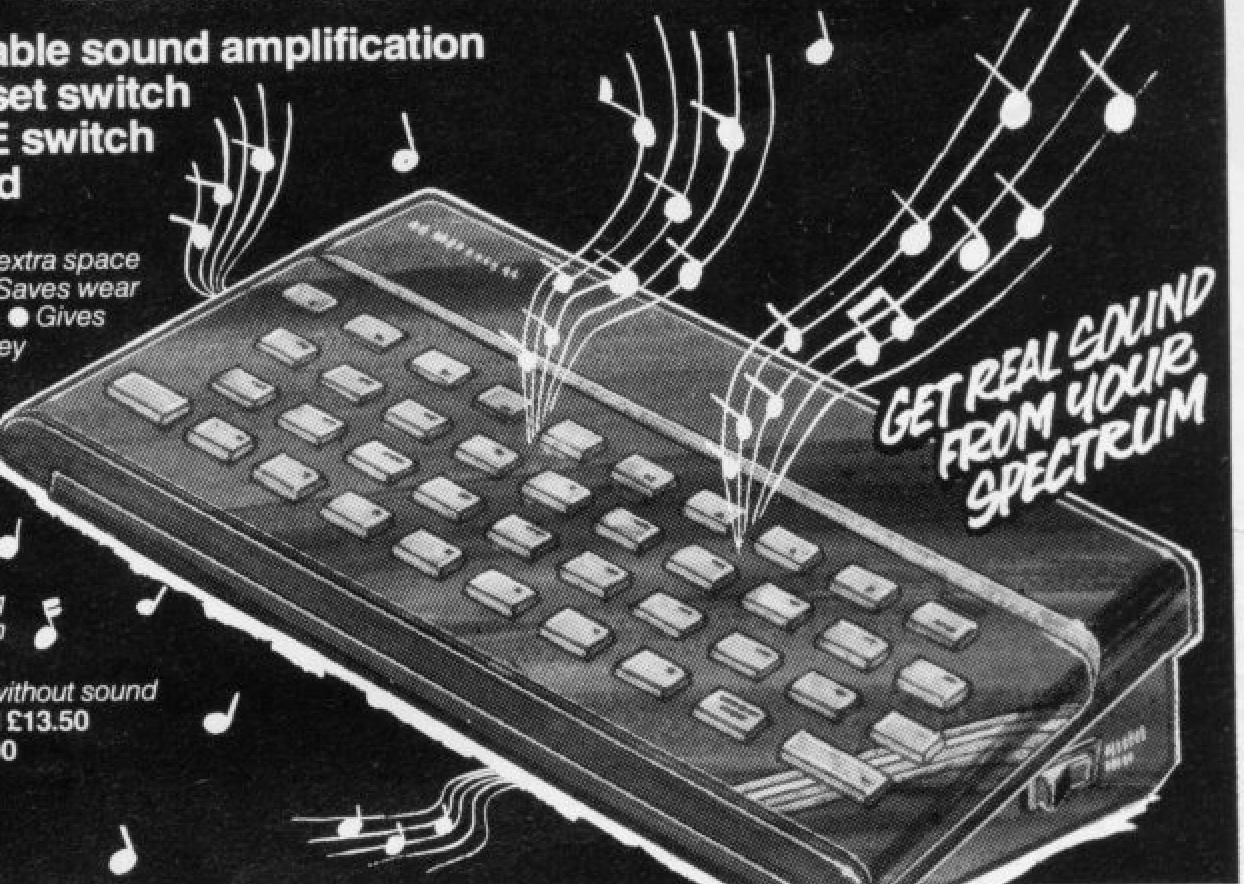
Table 1. Spectrum joystick demonstration routine. Note — lines 4035, 4036 and 4037 each print 32 spaces.

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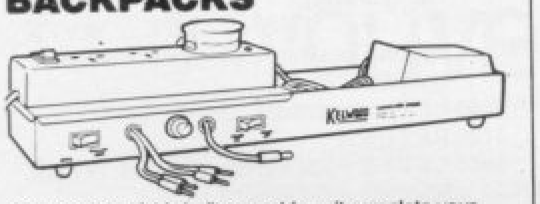
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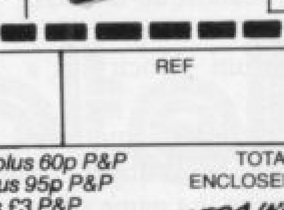


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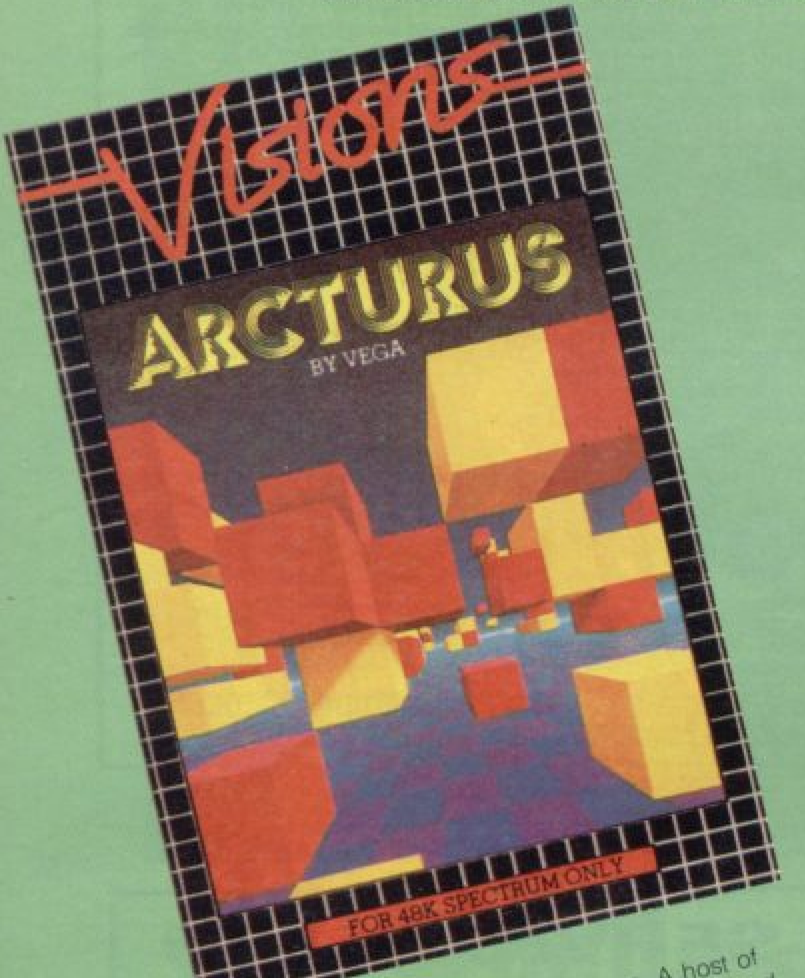
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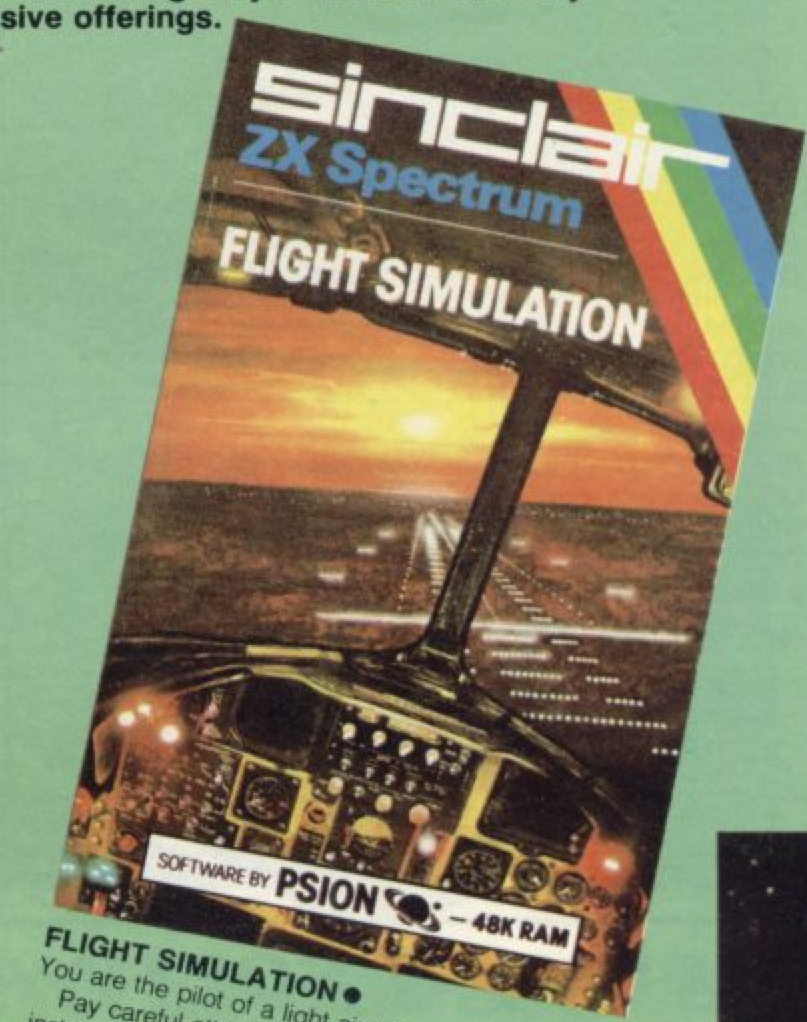
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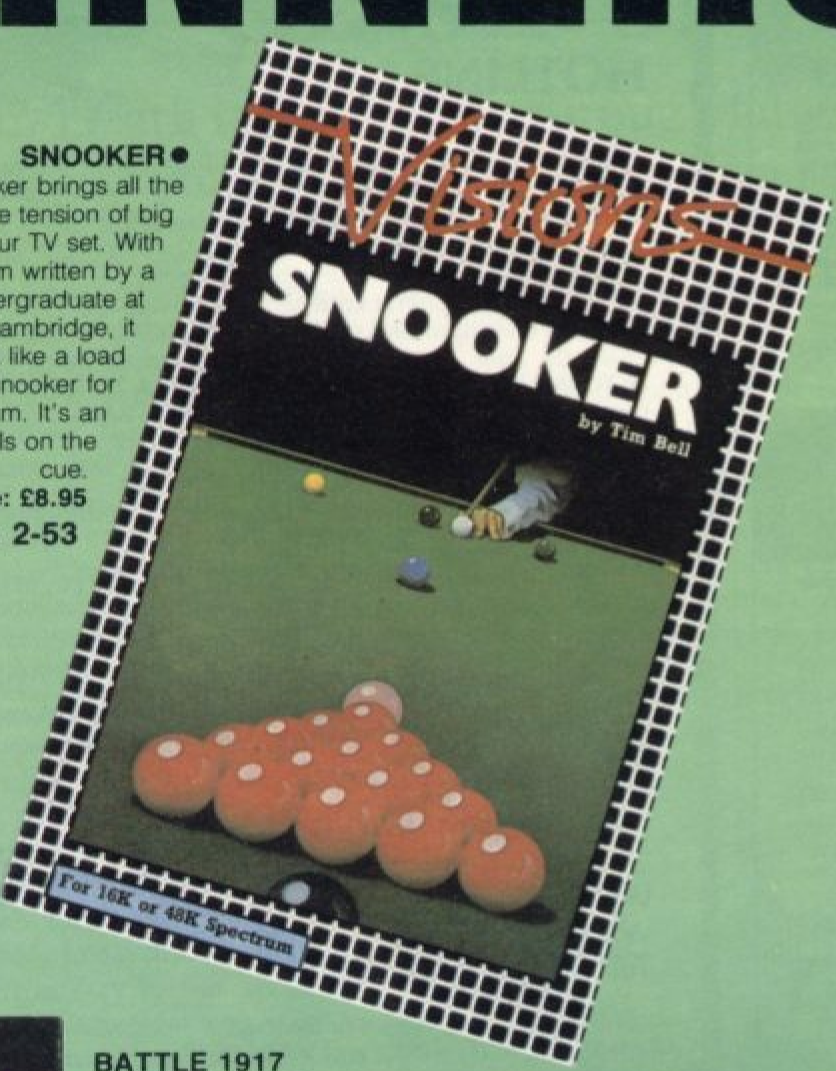
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The Clash of the Titans

Quentin Heath treads warily through labyrinths of Greek mythology.

MOST ADVENTURE games are set in the far future or in a past which the author and programmer have created. **Perseus and Andromeda** from Digital Fantasia, however, is different as it takes its plot from a Greek myth.

At the start of the 48K Spectrum game the main goal is to get into the royal palace to see the king. A good knowledge of the original myth would help you through the quest and in some cases that knowledge is imperative. The information on the card insert with the game is enlightening about the background to the characters involved in the story but a good book on the subject would be useful.

If you do not have a book I can tell you that the king is the one person who can tell you what you must do. The way in which you must ask him for your mission is odd, to say the least. Using formats such as 'say to' or 'speak to' followed by the statement you want to use enclosed in quotation marks will not work. It becomes obvious that you have to do something basic and unregal and EXAMINE KING.

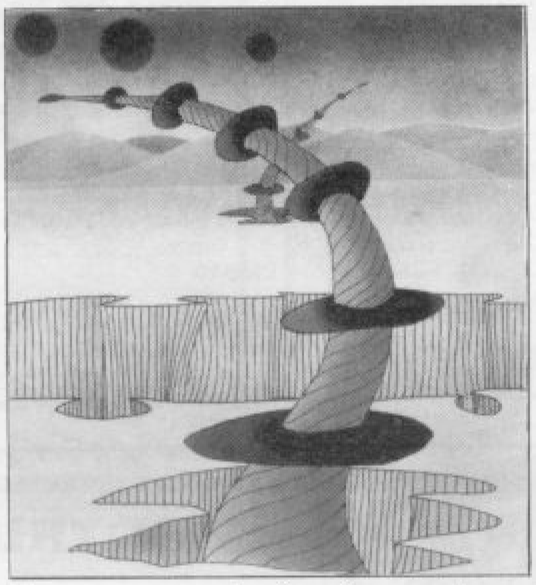
King Polydectes will not be very helpful even after you have been to all that trouble to find him. He will tell you to slay Medusa, who is the main protagonist, and rescue the Princess Andromeda whom you want as your bride.

Looking at the way in which you talk to the king, we can see two valuable points which will help in playing the adventure. First, characters seem to be treated as objects. For example, it is as if Polydectes is a statue, like the Delphic Oracle who, once disturbed, will make a suitably inspired but useless utterance.

The second point I want to raise is about the use of words in the adventure. Many games use words in the context of different situations but their meanings stay the same throughout the game. As you can see with the word EXAMINE, some of the words in Perseus and Andromeda have double meanings. EXAMINE can be used to mean 'look at the object in front of you' or, more suitably, it can mean 'interrogate the character, monster or object which is in front of you'.

The authors have used words in an eccentric manner. You will find the ploy irritating at times, especially when you are trying to figure how to get one of the treasures which form the first set of objectives in the game. My warning is to look for unusual ways of using commands in the game, as the authors seem to have flouted the rules of English.

In the original story Perseus had to find treasures or weapons with which he had to arm himself before he could think about chasing monsters. Among



the weapons to be found are a discus with an engraving of Mount Olympus on it, a shield which has been highly-polished by Athene, winged sandals from Hermes and a golden helmet also from Hermes. All but one of them can be found in the temples which are attributed to the various gods and goddesses of Greece.

There are various methods by which treasures can be obtained and if you manage to find the poor old beggar who inhabits a dried-out watering hole and is eternally thirsty you may also find a way to get what you want from the gods.

If you give the old man what he wants he will return the favour by giving you a discus. Examine the prize carefully and find the verb which you will need to use when you climb to the principle of success in the Temple of Athene. When you have reached that temple all you have to do is say your prayer to the goddess and wait. You will then be in possession of Athene's gift, which should be used against one of the only women in Greek mythology who does not need a permanent wave.

The most difficult of the treasures to obtain is the Golden Helmet. You will find it in the cave by the pool of water. It will be hanging from the head of a statue which refuses steadfastly to give up its treasures. I tried everything logical to get the hat, from climbing, jumping, and scaling the wall to invoking all gods using the 'pray' method.

I needed about half an hour to solve the problem, without using the help sheet provided by the author, but in the end I intend to give only a hint and tell you that you will kick yourself when you finally work out the puzzle. To knock the helmet from the statue you will need one of the objects. Pretend you are playing on a coconut shy and knock off the helmet.

When you have the helmet you will, no doubt, have solved the first part of the adventure. You will have used none of the objects collected so far, except for the water-carrying sack, but as a final fling you could take to the air.

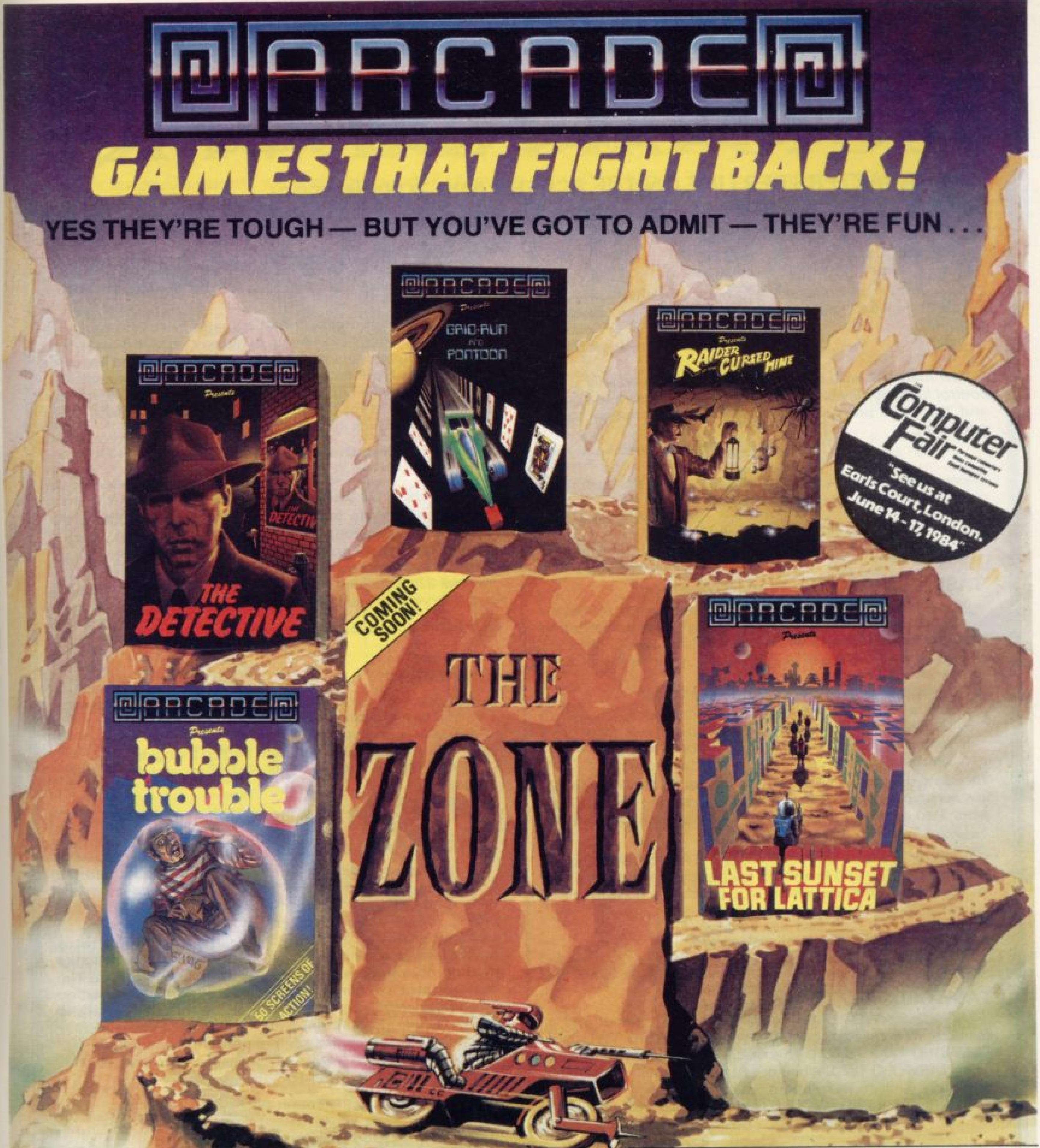
Return to the temple of the god who gave you the winged shoes. Put on the shoes and walk into the pedestal. I can tell you only that if you mount the pedestal you will not be able to fly.

The best way to move around the sky is to use the command word 'FLY', although others will do just as well. You will find that your flight path seems to be controlled by a greater power and the gods are obviously directing you to your next battleground.

The authors have crammed the main part of the story into the third part of the game. It is useful to know the general order in which you have to combat the monsters. First you must deprive the author's version of the Stygian witches of their all-seeing eye. After that you must defeat the Harpies and find Medusa's lair.

After defeating Medusa you must find Pegasus and ride him to defeat the Kraken and save Andromeda. The final part of the adventure is spoiled slightly because you can refer to the myth for a solution to a particular problem.

The adventure is faithful to the old Greek story but if you want to find extra hints you might like to see the film *Clash of the Titans,* or read the book. Those sources provide information on the plot and are also easier to read than the translation of the original.


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TASMAN SOFTWARE

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SOFTWARE DIRECTORY

If we have reviewed a cassette we have given it a rating known as the Gilbert Factor. That factor includes value for money, the screen layout, the conciseness and speed of the program, the accomplishment of the task it aims to achieve, and the use it makes of the machine.

ZX-81

Adventure

Adventure 1	Abersoft	6
Barrow Quest	Sherry	*
Black Crystal	Carnell	7
Dr. Whom	D. Biggs	*
Dungeons of Doom	Woosoft	*
Espionage Island	Artic	*
Greedy Gulch	Phipps	7
Inca Curse	Sinclair	*
Knight's Quest	Phipps	*
Lost Island	JRS	*
Magic Mountain	Phipps	*
Merchant of Venus	Crystal	7
Pharoah's Tomb	Phipps	*
Pimania	Automata	*
Secret Valley	Newsoft	*
Serpents Tomb	Vortex	*
The Great Western	New Soft	*
Time Bandits	New Soft	*
Tomb of Dracula	Felix	*
Volcanic Dungeon	Carnell	*
World of Illusions	Contrast	4

Arcade

Alien Dropout	Silversoft	*
Asteroids	Silversoft	8
Asteroids	Software Farm	6
Astral Convoy	Vortex	*
Bank Robber	Romik	6
Bubble Bugs	Romik	6
Byter	Protek	*
Cassette 1	Orwin	7
Cassette 2-5	Orwin	7
Defenda	Quicksilva	8
Door Slammer	Cathedral	7
Forty-Niner	Software Farm	9
Froggy	DJL	7
Full-screen Breakout	New Generation	*
Galactic Trooper	Romik	6
Galaxy Jailbreak	Romik	6
Games	P Teakle	*
Games 2	JRS	*
Games Tape 1	J K Greye	*
Games Tape 2	J K Greye	*
Games Tape 3	J K Greye	*
Gobbleman	Artic	*
Gobbler	Software Farm	*
Grand Prix	dK' Tronics	*
Gulp 2	Campbell	*
Hang Glider	S Electronics	6
Hickstead	CCS	5
High-resolution Invaders	Odyssey	*
Invaders	Abersoft	*
Invaders	Bug-Byte	*
Invaders	Odyssey	8
Invaders	Selec	7
Invaders	Silversoft	*
Krazy Kong	PSS	*
Maze Death Race	PSS	*
Maze Man	Abersoft	*
Mazogs	Bug-Byte	*
Namtir Raiders	Artic	8
Night Gunner	Digital Int.	5
Puckman	Hewson	*
Six Games	A Stubbs	5
Space Raiders	Sinclair	*
Space Trek	JRS	*
Swag + Voyager	Howard	*
3D Monster Maze	New Generation	9
Three Games Cassette	McGraw Hill	8
Zuckman	DJL	8
ZX Invasion Force	Artic	*
ZX Panic	Selec	4
ZX-81 1K Games Pack	Crystal	9
ZX-81 Pocket Book	Phipps	*

Business

Accounts (Limited company)	Hestacrest	*
Accounts (Sole Trader)	Hestacrest	*
Business Bank Account	Transform	*
Critical Path Analysis	Hilderbay	6
Draft	Myrmidon	*
Mailing List	Hestacrest	*
Payroll	Hilderbay	*
Payroll	Soft Tech	*
Payroll	Soft Tech	*
Personal Banking System	Hilton	*
Purchase Ledger	Hestacrest	*
Sales Day Book	Transform	*
Sales Ledger	Hestacrest	*
Text	Contrast	8

Education

Calpac 1-2	Calpac	*
Four Rules of Number	Micro Master	*
Integration	University	8
Intermediate English 1-2	Rose	*
Intermediate Maths 1-2	Rose	*
Language Devel. Series	Glasson	*
Language Devel. Series	Micro Master	*
Linear Programming	University	*
Matrix Operations	University	7
O Level Chemistry	Calpac	*
O Level French Revision	Rose	*
O Level Maths Revision	Rose	*
Polynomials	University	*
Primary Arithmetic	Rose	*
Regression	University	*
Self-teach Program	Anvil	*

Language

Forth	Sinclair	7
ZX Forth	Artic	8

Practical

Ephemeris	Bridge	7
Football Pools	Hartland	*

Puzzle

Nowotnik Puzzle	Phipps	*
Word Fit	Ram Writer	6

Simulation

Fighter Pilot	Digital Int.	5
Flight Simulation	Sinclair	6
Pilot	Hewson	7
Print Shop	CCS	*

Strategy

Airline	CCS	7
Auto Chef	CCS	7
Bank Raid	J M Senior	*
Battleships	JRS	*
Conflict	Martech	7
Cyborg Wars	Stratagem	7
Dallas	CCS	6
Farmer	CCS	*
Football Manager	Addictive Gms.	*
Fort Apache	Contrast	8
Galaxy Conflict	Martech	8
Great Britain Ltd	Hessel	*
Ocean Trader	Quicksilva	7
Pioneer Trail	Quicksilva	7
The Settler	BSS	*

Traditional

Do Not Pass Go	Work Force	*
Lynchmob	Bridge	6
Original Superchess	CP Software	*
Othello	M.O.I.	*
Tai	PSS	*
Tenpin	Phipps	*
ZX 1K Chess	Artic	*
ZX Compendium	Carnell	7
ZX-Chess I	Artic	*

Utility

Graphics	IPA	*
Graphics Toolkit	JRS	9
Machine Code Test Tool	OCP	*
MCoder	PSS	8
Programme Enhancement Package	R and R	*
Renumber Delete	Work Force	*
Sideways Copy	D King	*
Trace	Texgate	7
ZX Compiler	Silversoft	*
ZX Screenkit	Picturesque	*
ZX-81 Remload	Picturesque	*
ZX-Bug	Artic	*
ZX-sideprint	Microsphere	*
ZXAS	Bug-Byte	*
ZXDB	Bug-Byte	*

SPECTRUM 16K

Adventure

Android One	Vortex	*
Escape	New Generation	8
Mines of Saturn/Return to Earth	Mikro-Gen	*
Moria	Severn	*
Planet of Death	Artic	6
Secret Valley	Newsoft	*
The Great Western	New Soft	*
Time Bandits	New Soft	*

Arcade

Aquarius	Bug-Byte	6
Arcadia	Imagine	5
Arcadian	J K Greye	6
Assassin	Spectrasoft	*
Attack on New York	Fry	*
Avenger	Abacus	5
Baltic Patrol	E. Midland	*
Baron	Temptation	*
Base Invaders	Imagination	*
Black Hole	Quest	6
Blind Alley	Sunshine	7
Breakaway	Procom	*
Bug Blaster	Crystal	*
Cassette A	Orwin	*
Caterpillar	CDS	*
Cavern Fighter	Bug-Byte	4
Centi-bug	dK' Tronics	*
Children's Compendium	Dymond	*
City Defence	Mikro-Gen	*
Colour Clash	Romik	4
Cookie	Ultimate	*
Cosmic Guerilla	Crystal	8
Creepy Crawler	Mikro-Gen	*
Crevasse and Hotfoot	Microsphere	7
Cruising	Sunshine	4
Cyber Rats	Silversoft	7
Death Chase	Micromega	6
Demolition	Comp. Rentals	*
Destroyer	Winters	*
Di-lithium Lift	Hewson	3
Digger Dan	Ocean	*
Doombugs	Work Force	8
Dymonoids	Dymond	*
Earth Defence	Artic	5
Ed-On	Add-On	4
Eskimo Eddie	Ocean	*
Family Games Pack	Hornby	*
Fireflash	Abacus	5
Froggy	DJL	7
Fruit Line	P A Hanson	*

Fruit Machine	dK' Tronics	6
Galactians	dK' Tronics	*
Galactic Trooper	Romik	3
Galactic Warriors	Abacus	6
Galaxians	Artic	6
Games Pack 1	A Burnham	*
Games Tape 1-2	Sospan	*
Ghost Hunt	PSS	*
Gnasher	R & R	8
Gobble-a-Ghost	CDS	*
Gobbleman	Artic	*
Godzilla and Martians	Temptation	7
Gorilla	D Hornsby	*
Ground Attack	Silversoft	6
Ground Force Zero	Titan	*
Gulpman	Campbell	*
Haunted Hedges	Micromega	6
Hopper	PSS	6
Horace and the Spiders	Sinclair	8
Horace Goes Skiing	Sinclair	8
Hungry Horace	Sinclair	8
Invasion Force	Artic	8
It's the Wooluf	Crystal	5
Jet Pac	Ultimate	*
Jogger	Severn	*
Labyrinth	Axis	4
Leap Frog	CDS	*
Light Cycle	PSS	*
Luna Crabs	Micromega	7
Magic Meanies	CDS	2
Maze Chase	Hewson	8
Meteor Madness	Spectresoft	*
Meteor Storm	Quicksilva	7
Meteoroids	dK' Tronics	7
Meteoroids	Softek	6
Millypede	Add-on	7
Mined Out	Quicksilva	7
Moon Buggy	Visions	6
Muncher	Silversoft	*
Muncher	Silversoft	6
Nanas	Mikro-Gen	*
Orbiter	Silversoft	7
Ostron	Softek	*
Pengy	Micromania	4
Pitman Seven	Visions	*
Planetoids	Sinclair	8
Proteus	Abacus	5
Rapedes	Visions	*
Repulsar	Softek	*
Rider	Virgin	6
Road Toad	DK Tronics	7
Robot Panic	Soft Mill	1
Sam Spade	Silversoft	5
Santa	Artic	*
Sentinel	Abacus	7
Shark Attack	Romik	5
Sheer Panic	Visions	7
Shiva Special 1	Shiva	*
Sky Raider	C M Smith	*
Slippery Sid	Silversoft	8
Space Fighter	Winters	*
Space Intruders	Quicksilva	7
Space Lanes	Cathedral	*
Space Raiders	Sinclair	6
Space Zombies	Mikro-Gen	*
Spec. Frogs/ Showdown	Artic	*
Spec. Gobbleman	Artic	*
Spec. Invaders	Artic	*
Spec. Invasion Force	Artic	*
Spec. Scramble	Work Force	7
Spectipede	R and R	8
Spectral Invaders	Bug-Byte	8
Spectral Panic	Hewson	5
Spectres	Bug-Byte	6
Strike Four	Spectresoft	4
Styx	Bug-Byte	7
Sub	Romik	*
Tank Battle	dK' Tronics	8
The Devil Rides In	Carnell	*
3D Monster Chase	Romik	3
Train Game	Microsphere	9
Trom	dk'Tronics	4
Vortex	JK Greye	5
Winged Warlord	CDS	6
Wizard's Warriors	Abersoft	*
Yomp	Virgin	7

Business

Finance Manager	OCP	9
Home Computer Pack	SD Micro	*
Masterfile 16	Campbell	*
Matcalc	Work Force	*
Micropen	Contrast	*
Vu-Calc	Sinclair	7
Vu-File	Sinclair	8

Education

Alphabet	Widget	*
Alphabet Games	Sinclair	*
Apostrophe	Sinclair	7
Ballooning	Heinemann	*
Calpac 1-3	Calpac	*
Car Journey	Heinemann	*
Cargo	Sinclair	*
Chess Tutor	Artic	7
Counting	Starter Soft	*
Counting	Widget	*
Education One	Lerm	*
Educational	Startersoft	*
Firework Music	Soft Cottage	8
First Numbers	Collins	*
40 Education Games	Granada	*
Four Rules of Number	Micro Master	*
French Voc Test	Tutorial	*
Hidden Letters	Poppy	*
Hot Dot Spotter	Longman	*
Integration	University	8
Intermediate English 1-2	Rose	*
Intermediate Maths 1-2	Rose	*
Know Your Tables	Collins	*
Language Devel. Series	Glasson	*
Language Devel. Series	Micro Master	*
Learn Basic	Logic 3	*
Learning Read 1	Poppy	*
Linear Programming	University	*
Marks Book	Lerm	*
Maths Invaders	Stell	*
Maths Tutor	AD Software	*
Matrix Operations	University	7
Money	Poppy	*
Night Sky	Bridge	*
Number 6	Prime	*
O Level Maths	Homestudy	*
O Level Physics	Homestudy	*
Paddington's Shopping Mix-up	Collins	*
Pathfinder	Widget	*
Polynomials	University	8
Pre/early school cassettes	Essex	*
Primary Arithmetic	Rose	*
Punctuation Pete	Heinemann	*
Regression	University	8
Self-teach Program	Anvil	*
Shape Sorter	Widget	*
Special Agent	Heinemann	*
Spellbin	Startersoft	*
Teacheraid	B Farris	*
Use and Learn	Microl	8

Language

Beta Basic	Betasoft	9

Practical

Biorythms	Spectrasoft	*
Countries of the World	Hewson	8
Cycle Planner	Medidata	4
Map of the UK	Kuma	7
Shopping List	SD	*

Puzzle

Flippit	Sinclair	7
Hanoi King	Contrast	7
Lojix	Virgin	3
Nowotnik Puzzle	Phipps	7
Quazar	Rose	4

Simulation

Air Traffic Controller	Hewson	6
Airliner	Protek	6
Golf	R & R	7
Golf	Virgin	8
NightFlite	Hewson	5
Print Shop	CCS	8
Pro-Golf	Hornby	7

Strategy

Auto Chef	CCS	*
Big Match Soccer	Winters	*
Dallas	CCS	6
Dictator	Bug-Byte	*
Farmer	CCS	*
Football	Winters	*
Heathrow	Hewson	8
Las Vegas	Temptation	*
Quincy	Severn	*
The Settler	BSS	*

Traditional

Backgammon	Hewson	*
Bridge Tutor	CP	8
Bridgemaster	Bridgemaster	9
Challenge	Temptation	*
Gambling Tape	Dymond	*
Las Vegas	Temptation	5
Odds-on	RSD	*
Othello	CP Software	*
Othello	M.O.I.	*
Pinball	Winters	*
Pool	Bug-Byte	7
Reversi	Sinclair	8
Roulette	Newsoft	*
Solo Whist	Video Soft.	*
Spec. Microchess	Artic	*
Super Play 1	Video	*
Tennis	Winters	*

Utility

Auto Sonics	Buttercraft	5
Aspect	Bug-Byte	5
Audio Sonics	Work Force	4
Character Generator	Spectrasoft	*
Designer	Matrix	*
Dietron	Custom	6
Disassembler	dK' Tronics	7
Display	Work Force	*
Editor/Assembler	Picturesque	8
Extended Basic	CP	7
FP Compiler	Softek	9
Keysounder	S and G	*
Machine Code Test Tool	OCP	7
Master Toolkit	OCP	*
MCoder	PSS	8
Micro-print	Myrmidon	*
Micropen	Contrast	*
Peek	Zen	*
Print Utilities	Sinclair	7
Programmer's Dream	Work Force	8
Renumber Delete	Work Force	*
Slow Loader	ELR	9
Sound FX	dK' Tronics	6
Spec. Bug	Artic	*
Spec. Editor/ Assembler	Picturesque	8
Spec. Monitor	Picturesque	8
Spec. Sound	M Afzal	*
Spec. Tape Copier	S Giza	*
Spectrum Super Toolkit	Nectarine	8
Spectsound	PDQ	2
Supercode	CP	*
Tape Breaker	Spectrasoft	*
Tape Copier	Lerm	*
Taswide-64	Tasman	*
The Key	Keysoft	*
Trace	Texgate	8
Trace	Zen	*
X Ray	Zen	*
ZXED	dK' Tronics	*

SPECTRUM 48K

Adventure

Abyss	CCS	6
Ace in the Hole	Add-on	*
Adventure 1	Abersoft	6
Adventure Island	Contrast	*
Alchemist	Imagine	*
Arcane Quest	Add-on	*
Atlas Assignment	Virgin	7
Black Crystal	Carnell	7
Black Dwarf's Lair	Newsoft	*
Black Planet	Phipps	7
Byte	CCS	3
Castle Blackstar	SCR	7
Circus	Dig Fant	8
Classic Adventure	Melbourne Hse	*

Colditz	Phipps	8
Colossal Caves	CP	8
Cry Wolf!	Add-on	*
Crypt	Carnell	6
Demon Lord	MCE	5
Detective	Arcade	7
Devils of Deep	Shephard	*
Diamond Quest	CCS	4
Diamond Trail	Gilsoft	7
Dragonsbane	Quicksilva	6
Dungeon Master	Crystal Comp.	8
Dungeons of Doom	Temptation	3
Espionage Island	Artic	5
Everest Ascent	Shepard	6
Fantasia Diamond	Hewson	7
Golden Apple	Artic	7
Gorgon	Phipps	*
Halls of Things	Crystal Comp.	9
Here comes the sun	Alligata	7
Hobbit	Sin/Melborne Hse.	9
Hole	Add-on	*
Horror Atoll	Add-on	*
Inca Curse	Sinclair	6
Invincible Island	Shephard	8
Island	Crystal	4
Island	Virgin	7
Jericho Road	Shards	7
Jungle Adventure	CCS	4
Knight's Quest	Phipps	6
Leopard Lord	Add-on	4
Lords of Time	Level Nine	8
Lost Over Bermuda	Add-on	*
Mad Martha	Miko-Gen	7
Mad Martha II	Mikro-Gen	*
Mountains of Ket	Incentive	8
Murder at Manor	Gemtime	7
Oracle's Cave	Doric	8
Perseus and Adromeda	Dig Fant	7
Pimania	Automata	*
Quest	Hewson	7
Quetzalcoatl	Virgin	8
Roundsby Incident	Add-on	*
Satan's Pendulum	Minatron	7
Ship of Doom	Artic	7
Solaris	Softel	*
Superspy	Shepherd	5
Terror from The Deep	Add-on	*
The Castle	Bug-Byte	*
The Orb	Comp. Rentals	*
Time Quest	Mikro-Gen	*
Tomb of Dracula	Felix	*
Transylvanian Tower	Shepherd	7
Urban Upstart	Shepherd	*
Valhalla	Movisoft	7
Vampire Village	Terminal	4
Velnor's Lair	Quicksilva	8
Volcanic Dungeon	Carnell	6
Who Dares Wins	E. Midland	*
Wilfred the Hairy	Microbyte	2
Ziggarat of Dread	Add-on	*

Arcade

Ad Astra	Gargoyle Games	8
Adven. St. Bernard	Carnell	7
Android Two	Vortex	*
Ant Attack	Quicksilva	8
Armageddon	Silversoft	3
Atic Atac	Ultimate	8
Base Invaders	Work Force	6
Bear Bovver	Artic	8
Birds and Bees	Bug-Byte	8
Blade Alley	PSS	6
Blue Thunder	R Wilcox	6
Brain Damage	Silversoft	*
Bubble Trouble	Arcade	*
Bugaboo	Quicksilva	7
Caesar the Cat	Mirrorsoft	7
Centipoid Plus 3	Orwin	5
Chequered Flag	Sinclair	8
Chuckie Egg	A & F	8
Chuckman	CCI/Add-on	8
Close-In	Pulsonic	4
Corridors of Genon	New Gen.	9
Cruise Attack	Mikro-Gen	*
Cyber Zone	Crystal	*
Defenda	Interstella	2
Deffendar	Mikro-Gen	*
Defusion	Incentive	6
Demon	Microcosm	*
Demon Chase	Mansfield	4
Devil Rides In	Carnell	7
Di-Lithium Lift	Hewson	*
Dimension Destructors	Artic	8
Dinky Digger	Postern	4
Dodge City	Phoenix	7
Dr Franky and the Monster	Virgin	6
Elektro Storm	PSS	*
Energy 30,000	Elm	3
Eskimo Eddie	Ocean	4
Fred	Quicksilva	6
Freez Beez	Silversoft	*
Galaxy Attack	Sunshine	4
Harry Goes Home	Pulsonic	6
Hickstead	CCS	4
High Noon	Work Force	9
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Hunchback	Ocean	*
Invasion Body Snatch.	Crystal	9
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Jet Pac	Ultimate	8
Jet Set Willy	Software Projects	9
Killer Knight	Phipps	5
Knight Rider	Hewson	*
Krakatoa	Abbex	8
Krazy Kong	PSS	*
Laser Zone	Quicksilva	8
Last Sunset Lattica	Arcade	*
Lazatron	Contrast	*
Loony Zoo	Phipps	6
Lunar Jetman	Ultimate	8
Manic Miner	Bug-Byte	9
Maze Death Race	PSS	*
Maziacs	dK' Tronics	8
Mission Impossible	Silversoft	6
Mission Omega	Pulsonic	4
Monkey Biznes	Artic	7
Moon Alert	Ocean	*
Mr Wimpey	Ocean	7
Mummy Mummy	Lothlorien	6
Munnery's Mergatroids	Abacus	6
1994	Visions	4
Olympimania	Automata	6
Paratroopers	Rabbit	4
Pat the Postman	Mikro-Gen	*
Pedro	Imagine	7
Penetrator	Melbourne Hse	7
Pi-Balled	Automata	7
Pi-Eyed	Automata	6
Pssst	Ultimate	7
Pyramid	Fantasy	8
Raider Cursed Mine	Arcade	*
Reactor	Gemini	7
Rescue	Comp. Rentals	*
Rescue	Ocean	*
Rider	Virgin	6
Robot Riot	Silversoft	6
Rommels Revenge	Crystal	8
Scuba Dive	Durrell	9
Security Shelter	Add-on	*
Skull	Games Machine	5
Sorcery	Virgin	7
Space Station Zebra	Beyond	6
Spectron	Virgin	6
Splat	Incentive	8
The Guardian	PSS	6
The Pyramid	Fantasy	7
The Snowman	Quicksilva	8
3D Lunattack	Hewson	6
3D Seiddab Attack	Hewson	5
3D Star Wars	Add-on	1
3D Tunnel	New Generation	9
Time Gate	Quicksilva	8
Timebomb	CDS	7
Tobor	Add-on	7
Tranz Am	Ultimate	*
Traxx	Quicksilva	7
Tribble Trubble	Software Projects	8
Tube Train Terror	JRS	*
Tutankhamun	Micromania	8
Warlock of Firetop Mountain	Penguin	*
Wheelie	Microsphere	7
Worm Attack	Pulsonic	2
Xadom	Quicksilva	4

Business

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Accounts (Limited Company)	Hestacrest	*
Accounts (Sole Trader)	Hestacrest	*
Address File	SD Micro	*
Address Manager	OCP	7
Bank Account System	K Gouldstone	8
Bank Verifier	SD Micro	*
Business Bank Account	Transform	*
Cash Controller	Shepherd	7
Collector's Pack	Sinclair	7
Critical Path Analysis	Hilderbay	*
Database	Microl	7
DIY Book-keeping	RAMTOP	*
Masterfile	Campbell	8
Omnicalc	Microsphere	9
Payroll	Hilderbay	9
Personal Banking System	Hilton	*
Personal Financ. Management Syst.	Fulwood	*
Sales Day Book	Transform	*
Small Business Accounts	Sinclair	*
Spreadsheet	Microl	7
Tasword	Tasman	8
Tasword II	Tasman	9
Utility File	SD Micro	*
Word Processor	Microl	*

Education

ABC Liftoff	Longman	*
Angle	Chalksoft	5
Angle Turner	Arnold Wheaton	7
Astro Maths	Scisoft	6
Castle Spellerous	Sinclair	8
Chess Tutor 1	Sinclair	7
Countabout	Longman	*
French is Fun	CDS	5
French Mistress	Kosmos	*
French Voc Test	Tutorial	*
German is Fun	CDS	8
German Master	Kosmos	*
Guitar Tutor 1	Harlequin	*
Guitar Tutor 2	Harlequin	*
Handwriting	Chalksoft	*
Humpty Dumpty	Widget	8
Inkosi	Chalksoft	5
Jungle Jumble	Clever Cloggs	*
Jungle Maths	Scisoft	*
Learn to Read 1-5	Sinclair	7
Letters and Numbers	Jimjams	*
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Make-a-Chip	Sinclair	*
Mansfield Park	Sussex	7
Mathskills II	Griffin	7
Model Maths	Jive	*
Mr. Men	Mirror	*
Musicmaster	Sinclair	6
Nineteenth C. England	Sussex	8
O Level Chemistry	Calpac	*
O Level Physics	Think Tank	*
Party Time	C. Tutor	*
Pathfinder	Widget	7
Pirate	Chalksoft	7
Quick Thinking	Mirrorsoft	*
Sequences	Chalksoft	5
Spanish Gold	Chalksoft	*
Speak and Spell	S and G	*
Speech Marks	Sinclair	7
Star Reader	Scisoft	*
Teach Data	B Farris	*
Teacher Data	B Farris	8
Tense French	Sulis	7
Time Traveller	Willey	*
Tuner	Soft Cottage	*
Whizz Kid	Comp. Tutor	*
Wizard Box	Scisoft	*

Language

Forth	Melbourne Hse.	9
Forth	Sinclair	7
Micro Prolog	Sinclair	8

Pascal Compiler	Hi-Soft	*
Snail Logo	CP	8
Spec. Forth	Abersoft	9
Spec. Forth	CP	8
ZX Forth	Artic	8

Practical

Beamscan	Beamscan	9
Cricket Averages	Spartan CC	7
Diet	dK' Tronics	*
Diet Master	Diet Master	6
Dietician	Keysoft	4
Engine Diagnostic	Spectrasoft	*
First Aid	Eastmead	4
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I Ching	Salamander	7
I Ching	Sirius	*
Personal Reminder	SD Micro	*
Star Gazer	CRL	8
The Complete Guide to Medicine	Eastmead	4
World Info	Wimsoft	*

Puzzle

Arcturus	Visions	7
Computaword	Work Force	2
Hanoi King	Contrast	*
Jumbly	dK' Tronics	*
Mazecube	PAL	6
3D Strategy	Quicksilva	8

Simulation

Fighter Pilot	Digital Int.	*
Flight Simulation	Sinclair	6
Golf	dK' Tronics	*
Inkos	Chalksoft	*
Royal Birkdale	Ocean	*
Strike Attack	Micromart	4
Test Match	Comp. Rentals	*
The Forest	Phipps	7
Troon	Hornby	8

Strategy

Airline	CCS	7
Angler	Virgin	6
Apocalypse	Red Shift	*
Battle 1917	CCS	8
Battle of Britain	Microgame	*
Brewery	CCS	8
British Lowland	CCS	*
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Derby Day	Comp. Rentals	*
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Galaxy Conflict	Martech	8
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King Arthur	E. Midland	*
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Scatterbrain	Manor	7
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Special Operations	Lothorien	8
Stonker's	Imagine	8
Tradewind	WDS	*
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Warlord	Lothlorian	*

Traditional

Backgammon	CP	7
Brag	T Lebon	7
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County Cricket	Allanson	6
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ZX-Chess II	Artic	*

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Basic Utilities	Jaysoft	6
Beyond Basic	Sinclair	*
Cartoon Animation	Fowler	*
Compiler	Softek	6
Composer	Contrast	2
DLAN	Campbell	*
Football	Digital Int.	*
FP Compiler	Softek	9
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Quill	Gilsoft	9
Softalk 1-2	CP	8
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Spectadraw 2	McAlley	*
Spectasort	Spectadraw	4
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